Sun Ultra™ 24 Workstation
Service Manual

Adobe PostScript™

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Preface

The *Sun Ultra 24 Workstation Service Manual* provides a detailed description of the hardware and software applications used to support the Sun Ultra 24 Workstation. This book is intended for system administrators, network administrators, or service technicians who have knowledge of workstation hardware and software.

How This Document Is Organized

Chapter 1 provides an overview of the Sun Ultra 24 Workstation.

Chapter 2 describes how to connect external cables and power on or off the workstation.

Chapter 3 provides visual inspection and troubleshooting procedures.

Chapter 4 describes how to run diagnostics and remove or replace the diagnostic partition.

Chapter 5 describes how to remove and replace components.

Appendix A contains information about system specifications.

Appendix B contains information about BIOS POST codes.

Shell Prompts

Shell	Prompt
C shell	*machine-name*%
C shell superuser	*machine-name*#
Bourne shell and Korn shell	$
Bourne shell and Korn shell superuser	#

Typographic Conventions

Typeface*	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; onscreen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
AaBbCc123	What you type, when contrasted with onscreen computer output	`%` **`su`** `Password:`
AaBbCc123	Book titles, new words or terms, words to be emphasized. Replace command-line variables with real names or values.	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be superuser to do this. To delete a file, type `rm` *filename*.

* The settings on your browser might differ from these settings.

Related Documentation

The document set for the Sun Ultra 24 Workstation is described in the *Where to Find Sun Ultra 24 Workstation Documentation* sheet that is packed with your system. All documents are posted at:

http://docs.sun.com/app/docs/prod/ultra24

Translated versions of some of these documents are available at:

http://docs.sun.com

Select a language from the drop-down list and navigate to the Sun Ultra 24 Workstation document collection using the Workstations category link. Available translations for the Sun Ultra 24 Workstation include Simplified Chinese, Traditional Chinese, French, Japanese, and Korean, Spanish, Italian, and German).

English documentation is revised more frequently and might be more up-to-date than the translated documentation.

Documentation, Warranty, Support, and Training URLs

Sun Function	URL	Description
Hardware Documentation	http://www.docs.sun.com	Sun hardware documentation
Software Documentation	http://www.docs.sun.com	Solaris OS and other software documentation
Warranty	http://www.sun.com/service/support/warranty/index.html	View specific details regarding your warranty
Support	http://www.sun.com/support/	Obtain technical support, including patches
Training	http://www.sun.com/training/	Learn about Sun courses and educational offerings

Ordering Components

You can order additional components and replacement parts for the Sun Ultra 24 Workstation. Contact your local Sun sales representative for more information. For the most up-to-date component information, see the Sun Ultra 24 Workstation components list at:

http://sunsolve.sun.com/handbook_pub/

Third-Party Web Sites

Sun is not responsible for the availability of third-party web sites mentioned in this document. Sun does not endorse and is not responsible or liable for any content, advertising, products, or other materials that are available on or through such sites or resources. Sun will not be responsible or liable for any actual or alleged damage or loss caused by or in connection with the use of or reliance on any such content, goods, or services that are available on or through such sites or resources.

Safety Information

Read the following documents for safety information:

- *Important Safety Information for Sun Hardware Systems*
- *Sun Ultra 24 Workstation Safety and Compliance Guide*

Sun Welcomes Your Comments

Sun is interested in improving its documentation and welcomes your comments and suggestions. You can submit your comments at:

http://www.sun.com/hwdocs/feedback/

Please include the title and part number of your document with your feedback:

Sun Ultra 24 Workstation Service Manual, 820-2480-11

Sun Ultra 24 Workstation Hardware Features

This chapter provides an overview of the Sun Ultra 24 Workstation hardware features, and includes the following sections:

- Section 1.1, "Front Panel" on page 1-2
- Section 1.2, "Back Panel" on page 1-3
- Section 1.3, "Internal Components and Cables" on page 1-4

1.1 Front Panel

lists the front panel components.

FIGURE 1-1 Front Panel Components
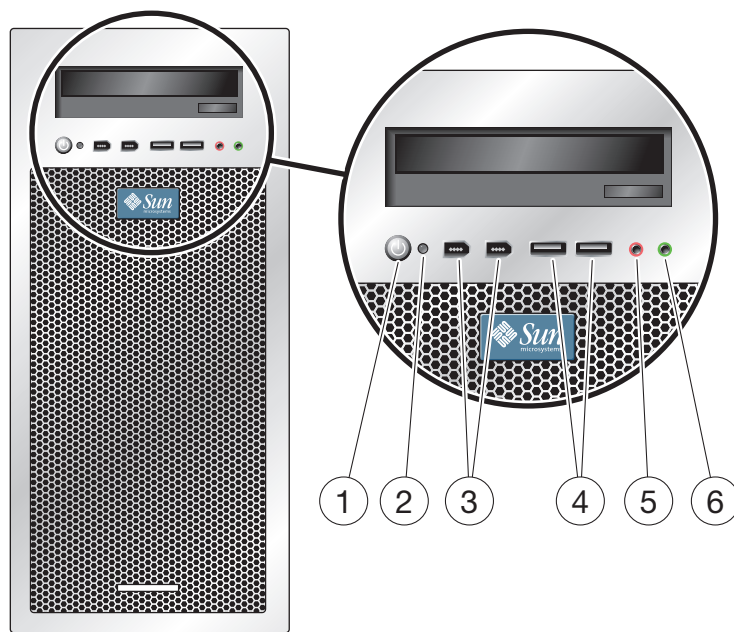
Figure Legend

1	Power Button	**4**	Two USB 2.0 ports
2	Power LED	**5**	Microphone-in jack
3	Two 1394 ports	**6**	Microphote-out jack

1.2 Back Panel

FIGURE 1-2 lists the back panel components.

FIGURE 1-2 Back Panel Components
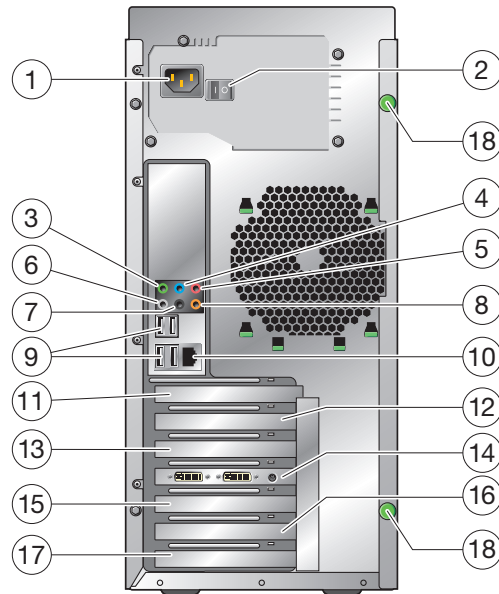
Figure Legend

1	Power Connector	**10**	Ethernet port
2	Power switch	**11**	Blank, unsed
3	Audio connector	**12**	x16 PCIe slot
4	Audio connector	**13**	x1 PCIe slot
5	Audio connector	**14**	x16 PCIe slot
6	Audio connector	**15**	PCI slot
7	Audio connector	**16**	PCI slot
8	Audio connector	**17**	PCIe x8 (4,1) slot
9	Four USB Ports	**18**	Release screws (captive) for left side access cover

1.3 Internal Components and Cables

1.3.1 Internal Components

FIGURE 1-3 lists the internal components and connectors.

FIGURE 1-3 Internal System Components
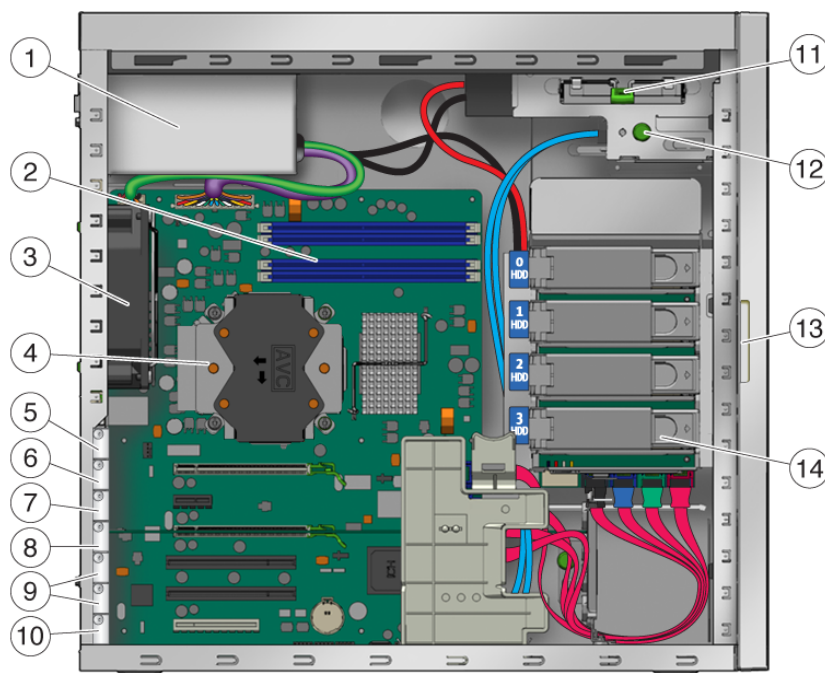
Figure Legend

1	Power supply	**8**	x16 PCIe slot
2	Memory (DIMMs)	**9**	Two PCI slots
3	System fan	**10**	PCIe x8 (4,1) slot
4	Heatsink and CPU	**11**	DVD release lever
5	Blank unused slot	**12**	I/O board release screw (captive)
6	x16 PCIe slot	**13**	Hard drive cage
7	x1 PCIe slot	**14**	Hard drives

1.3.2 Power Supply Cables and Connections

FIGURE 1-4 lists the power supply connections called.

FIGURE 1-4   Power Supply and Component Cable Connections to Motherboard
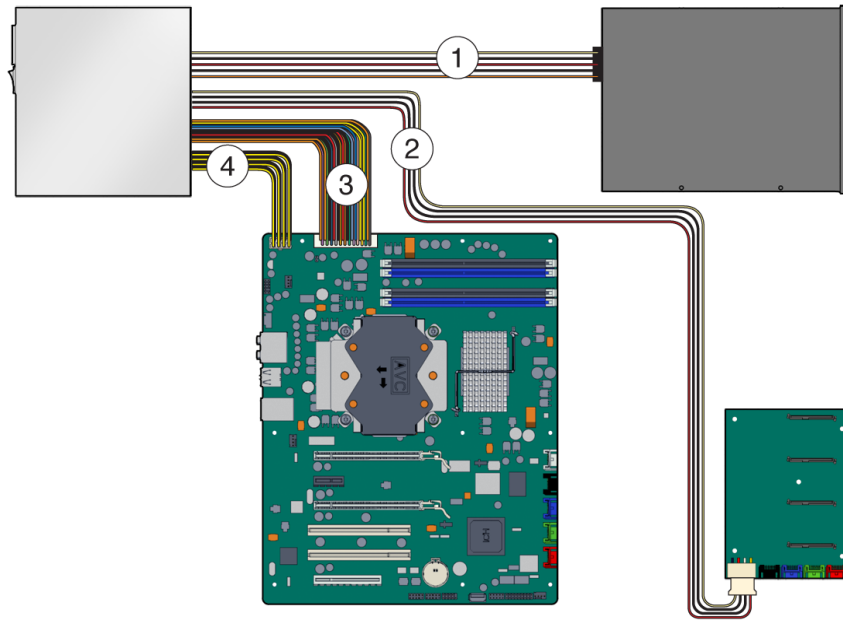
Figure Legend

1	Power supply to DVD drive
2	Storage Backplane
3	Power supply P1 to motherboard PWR1
4	Power supply P2 to motherboard PWR2

1.3.2.1 Component Cables and Connections

FIGURE 1-5 lists the component cables and connections.

FIGURE 1-5 Internal Component Cables and Connections
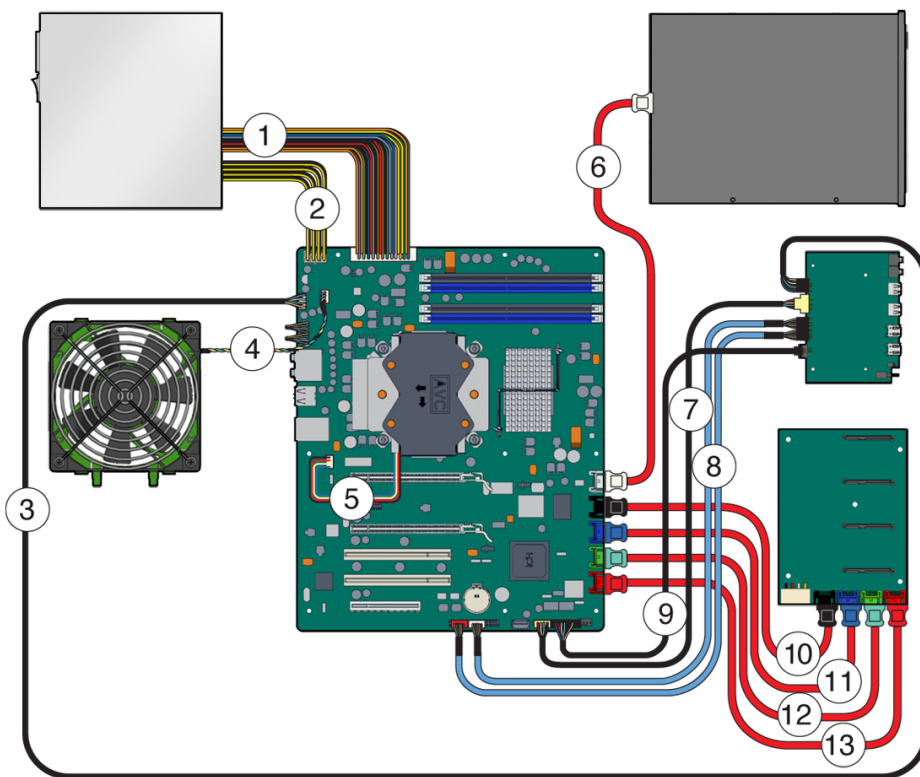
Figure Legend

1	Power supply P1 to MB PWR1	**8**	I/O Board J8 to MB 13940-0 and 1394-1
2	Power supply P2 to MB PWR2	**9**	I/O Board J12 to MB FPB_CONN
3	I/O Board J1 to MB FPB_Audio	**10**	SATA 1 to Storage Backplane HDD1 (black)
4	System Fan to MB SYS_FAN	**11**	SATA 2 to Storage Backplane HDD2 (blue)
5	CPU Fan to MB CPU_FAN	**12**	SATA 3 to Storage Backplane HDD3 (green)
6	DVD to MB SATA 0 (white)	**13**	SATA 4 Storage Backplane HDD4 (red)
7	I/O Board J5 to MB FPB_USB		

Unpacking, Cabling, and Powering the Sun Ultra 24 Workstation

This chapter describes how to connect cables and power the Sun Ultra 24 Workstation on and off. The chapter includes the following sections.

2.1 Planning the Installation Process

Use the following flowchart to assist you with installing the Sun Ultra 24 Workstation.

START

Unpack the workstation and familiarize yourself with the workstation features.

See Chapter 1.

Install optional components? — Yes → Install optional components.

For information about how to install DIMMs, a graphic accelerator, PCI or PCIe cards, hard drives, or a DVD drive, see Chapter 5.

No

Connect the workstation and external device cables.

See Section 2.3, "Connecting External Devices to the Workstation" on page 2-4.

Power on the workstation.

See Section 2.4, "Powering On the Workstation" on page 2-5.

Configure preinstalled OS software? — No → Install your OS.

To install an optional, supported OS, see the *Sun Ultra 24 Workstation Operating System Installation Guide*.

Yes

Configure the preinstalled Solaris 10 Operating System.

See the *Sun Ultra 24 Workstation Installation Guide*.

READY TO WORK!

FIGURE 2-1   Process Flow for Setting Up the Sun Ultra 24 Workstation

2.2 Checking Package Contents

Carefully unpack all workstation components from the packing cartons. The following items are contained in the package.

TABLE 2-1   Items Included in the Sun Ultra 24 Workstation Box

Hardware	• Sun Ultra 24 Workstation • DMS-59 cable (if the workstation is configured with an NVS290 graphics card)
DVD	• Sun Ultra 24 Workstation Tools and Drivers DVD (includes drivers and diagnostic software)
Documentation*	• *Sun Ultra 24 Workstation Installation Manual* • *Where to Find Sun Ultra 24 Workstation Documentation* (lists available online documents for this product) • Sun safety and license documents • Welcome letter

* Depending on the system configuration ordered, some systems might not include documentation or the Tools and Drivers DVD.

A country kit is optional, ships in a separate package, and includes a power cable, keyboard, and mouse.

2.3 Connecting External Devices to the Workstation

FIGURE 2-2 illustrates the external device cable connections to the workstation.

FIGURE 2-2   External Cable Connections
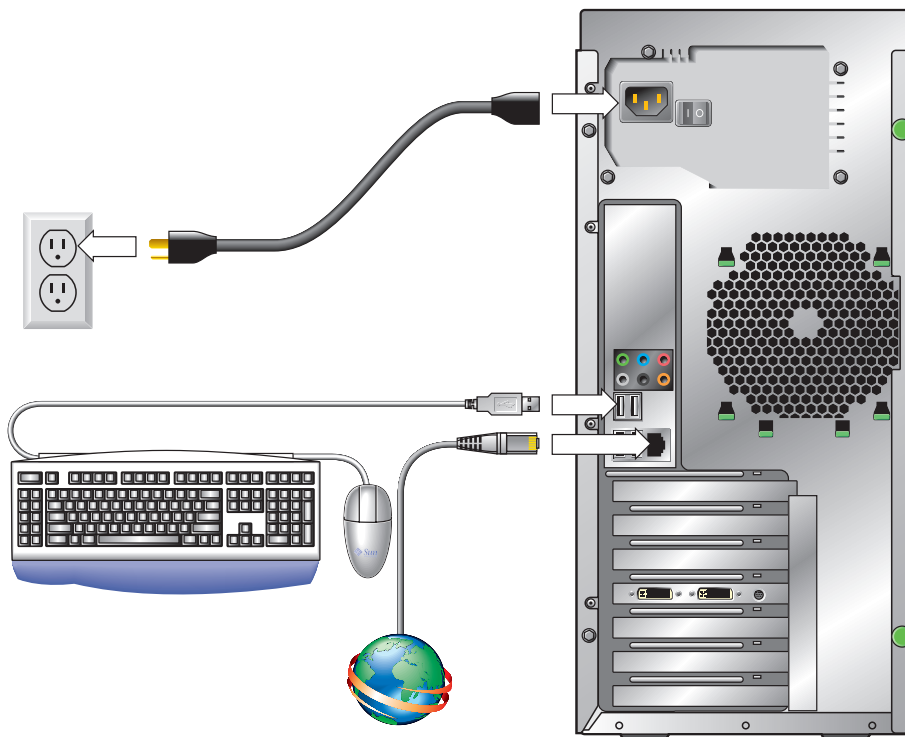
To connect external devices to the workstation:

1. **Connect the workstation power cord to a grounded electrical outlet.**

2. **Connect the keyboard to a USB connector on the back or front panel.**

3. **Connect the mouse to the USB connector on the underside of the keyboard or to a USB connector on the front or back panel.**

4. **Connect the Ethernet cable to the Ethernet connector on the Sun Ultra 24 Workstation, and connect the other end of the cable to an Ethernet RJ-45 jack.**

5. **Connect the monitor cable to the external port of the PCIe graphics card that is installed in the PCIe-2 slot (fourth slot from the bottom); see** FIGURE 2-3**.**

   Your graphics card might require a DVI cable to connect to your monitor.

FIGURE 2-3 Connecting the Monitor to the System Image
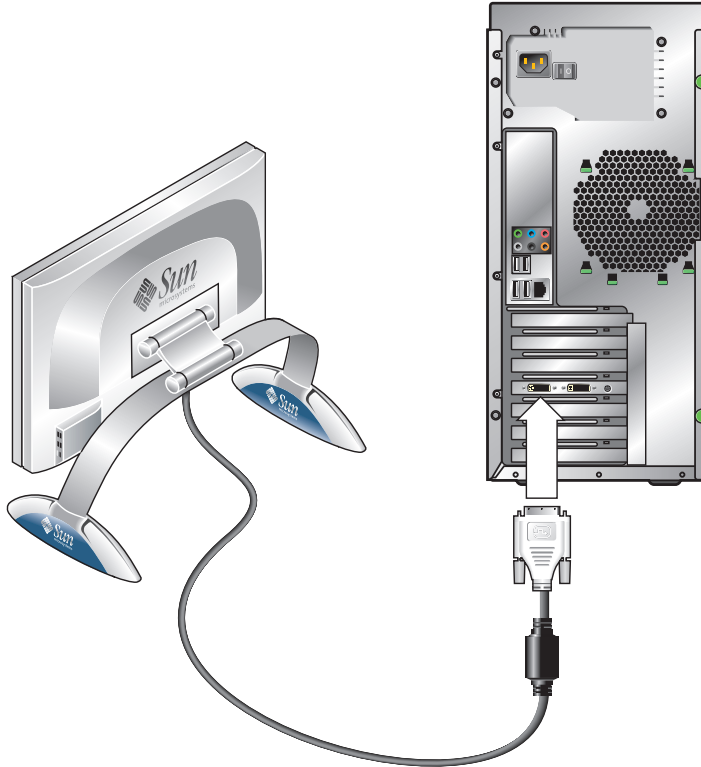
6. **Connect any additional external devices to the workstation's other connectors.**

2.4 Powering On the Workstation

To power on the workstation:

1. **Turn on the power to the monitor and to all external devices.**

2. **Turn the power switch on the rear of the workstation to the On (|) position.**

3. **Press and release the power switch on the front panel.**

4. **After several seconds, verify that the Platform Power LED next to the power switch is lit.**

   The Platform Power LED lights after the workstation begins the internal booting process.

5. **If you need to change the system parameters in the BIOS, press the F2 key during the POST process to access the BIOS Setup Utility.**

Caution – Be careful when making changes to the system BIOS, as some changes can cause your system to malfunction.

2.5   Powering Off the Workstation

To power off the workstation:

1. **Save your data, and close any open applications.**

2. **Read both of the following power-off options, and then follow one of the options to turn off the workstation.**

   - Power off the workstation by using the operating system shutdown command or menu option.

   - In most cases, this initiates an orderly shutdown of the operating system and shuts off the workstation power.

Caution – To avoid data loss, use the first option whenever possible.

   - If the first option does not shut off the workstation power, press and hold the power button for approximately four seconds.

     This option shuts down the power to the workstation but does *not* initiate an orderly shutdown of the operating system. This option might result in data loss.

   If the proceeding options do not power off the workstation, turn the power switch on the back panel to the off (**0**) position.

   After powering off the workstation, wait at least four seconds before powering on the workstation again.

Troubleshooting

This chapter describes visual inspection and troubleshooting procedures, and provides contact information if you require technical assistance. The following sections are included in this chapter:

- Troubleshooting Overview
- Section 3.2, "Visual Inspection" on page 3-2
- Section 3.3, "Troubleshooting Procedures" on page 3-3
- Section 3.4, "Obtaining Technical Assistance" on page 3-7

3.1 Troubleshooting Overview

Before troubleshooting your specific workstation problem, collect the following information:

- What events occurred prior to the failure?
- Was any hardware or software modified or installed?
- Was the workstation recently installed or moved?
- How long has the workstation exhibited symptoms?
- What is the duration or frequency of the problem?

After you assess the problem and note your current configuration and environment, you can choose from several ways to troubleshoot your workstation.

- Visually inspect your system as described in Section 3.2, "Visual Inspection" on page 3-2.
- See the troubleshooting procedures described in Section 3.3, "Troubleshooting Procedures" on page 3-3.
- Execute diagnostics tests as described in Chapter 4.

If you are not able to resolve the problem, contact Sun technical support. Support numbers and web sites are listed in Section 3.4, "Obtaining Technical Assistance" on page 3-7.

3.2　Visual Inspection

Improperly set controls and loose or improperly connected cables are common causes of problems with hardware components. When investigating a system problem, first check all external switches, controls, and cable connections.

If an external visual inspection does not resolve your problem, visually inspect the system's interior hardware for problems such as a loose card, cable connector, or mounting screw.

3.2.1　To Perform an External Visual Inspection

1. **Shut down the operating system, if necessary, power off the platform power on the front of the workstation and power off any attached peripherals (if applicable).**

2. **Verify that all power cables are properly connected to the system, the monitor, and peripherals, and check their power sources.**

3. **Inspect connections to any attached devices, including network cables, keyboard, monitor, and mouse.**

3.2.2　To Perform an Internal Visual Inspection

1. **Shut down the operating system, if necessary, and turn off the platform power on the front of the workstation.**

2. **Turn off the AC power on the back of the workstation.**

3. **Turn off any attached peripherals, but do not disconnect the power cables.**

4. **Remove the left side access panel, following the procedures in** Section 5.2, "Opening the Workstation" on page 5-2**.**

Caution – Some components, such as the heatsink, can become extremely hot during system operations. Allow these components to cool before handling them.

5. Verify that the components are fully seated in their sockets or connectors and that the sockets are clean.

6. Verify that all cables inside the system are firmly attached to their appropriate connectors.

7. Replace the left side access panel.

8. Reconnect the system and any attached peripherals to their power sources, and then power them on.

3.3 Troubleshooting Procedures

TABLE 3-1 lists possible problems that might arise during the use of your workstation. Possible solutions are listed for each problem. If the solutions listed here do not fix the problem, run the appropriate diagnostic test (see Chapter 4).

As you work, keep notes in case you need to call Sun technical support:

TABLE 3-1   Troubleshooting Procedures

Problem	Possible Solution
Workstation does not power on when the front panel Power button is pressed.	• Is the Power LED illuminated on the front of the system? Ensure that the power cord is connected to the system and to a grounded power receptacle. • Does the wall outlet have power? Test by connecting another device. • Does the system beep when the system is powered on? The system beeps when no keyboard or a malfunctioning keyboard is plugged in. • Does the monitor sync within 5 minutes after the power-on? The green LED on the monitor stops flashing and remains illuminated. • Is the monitor connected to the onboard video connector or PCI Express video card? Connect the monitor to the active video connector.
Workstation halts during POST without displaying error messages.	Check the BIOS POST LED display on the motherboard. See Appendix B for detailed information about the POST codes.
Workstation powers on, but the monitor does not.	• Is the Power button for the monitor turned on? • Is the monitor power cord connected to a wall outlet? • Does the wall outlet have power? Test by connecting another device. • Is the monitor connected to the onboard video connector or PCI Express video connector?
Workstation does not power off when the front panel Power button is pressed.	• Try all of the power-off options described in Section 2.5, "Powering Off the Workstation" on page 2-6. • If the workstation still does not power off, disconnect the power cable from the back of the chassis.
Workstation appears to be in low-power mode, but the Power LED does not blink.	The Power LED blinks only when all workstation components are in low-power mode. A tape drive might be connected to your workstation. Because tape drives do not enter low-power mode, the power LED does not blink.
Unable to access the network.	• Check the cabling and network equipment to make sure that all cables are correctly seated. • Reinstall the network drivers.

TABLE 3-1 Troubleshooting Procedures *(Continued)*

Problem	Possible Solution
Newly installed memory is not detected.	• Make sure that the memory is properly seated on the DIMM sockets. • Move the memory to the other DIMM socket to determine whether the socket is defective. • Make sure that you are using 512 MB, 1 GB, or 2 GB registered DDR2 667 SDRAM modules with 3.05 cm maximum height. • Make sure that the memory is installed in pairs.
System cannot read the disk information.	Check to see that the disk is properly seated. If that does not resolve the issue, do the following: 1. Turn off the workstation by pressing the Power button. 2. Remove the left side access panel. 3. Check to make sure that the power and data cables are connected to the backplane of the disk drive and that the pins in the cable and connector are not bent. 4. Replace the left side access panel. 5. Turn on the workstation.
DVD does not eject from the drive the Eject button is pressed.	• Move the mouse or press any key on the keyboard. The drive might be in the low-power mode. • Use the utility software installed on your workstation to eject the DVD.
System cannot read DVD information.	Check the following: • Are you using the correct type of DVD? • Do other DVDs work in this drive? • Is the DVD properly inserted in the drive? • Is the DVD clean and unscratched? • Are the cables connected to the DVD drive?
Keyboard or mouse does not respond to actions.	• Are the keyboard and mouse Type 7? Verify the model on the underside of the keyboard. • Verify that the mouse and keyboard cables are connected to the onboard USB 2.0 connectors on the workstation. • Verify that the workstation is powered on and that the front Power LED is illuminated.

TABLE 3-1   Troubleshooting Procedures *(Continued)*

Problem	Possible Solution
Hung or frozen workstation: no response from mouse or keyboard or any application.	Are the keyboard and mouse Type 7? Verify the model on the underside of the keyboard. Try to access your system from a different workstation on the network. 1. From a terminal window, enter **ping** *hostname* 2. If there is no response, remotely log in from another system, using `telnet` or `rlogin`, and ping the system again. 3. Attempt to kill processes until the system responds. If the above procedures do not work: 1. Press the Power button to power off the system. 2. Wait 20 to 30 seconds and power on the system. See Section 2.5, "Powering Off the Workstation" on page 2-6 for more detailed information.
There is no video display on the monitor screen.	Check the following: Try to access your system from a different workstation on the network. 1. From a terminal window, enter **ping** *hostname* 2. If there is no response, remotely log in from another system, using `telnet` or `rlogin`, and ping the system again. 3. Attempt to kill processes until the system responds. If these procedures do not work: 1. Press the Power button to power off the system. 2. Wait 20 to 30 seconds and power on the system. See Section 2.5, "Powering Off the Workstation" on page 2-6 for more detailed information. • Is the monitor power cord connected to the power outlet? • Does the wall outlet have power? Test it by connecting another device. • Is the video card seated correctly in its connector? • Are the internal cables properly connected to the video card? • Does the monitor work when connected to another system? • If you have another monitor, does it work when connected to the original system? • Verify that the BIOS settings are correct.

TABLE 3-1   Troubleshooting Procedures *(Continued)*

Problem	Possible Solution
An external device connected to a USB connector does not work.	• Reduce the number of external devices connected to a USB hub. • Connect the device to a USB hub, and connect the hub to the USB ports on the workstation. • Refer to the documentation that is packaged with the device.
External device is not working.	• Check the documentation packaged with the device to determine whether you must install device drivers. • Ensure that the cables for the external device are firmly connected, and that the pins in the cable and connector are not bent. • Power off the system, reattach the external device, and power on the system.

3.4   Obtaining Technical Assistance

If the troubleshooting procedures in this chapter fail to solve your problem, you can receive additional technical support at the Sun web sites and telephone numbers listed in TABLE 3-2.

TABLE 3-2   Sun Web Sites and Telephone Numbers

Workstation Documents and Support Resources	URL or Telephone Number
PDF files for all the current Sun Ultra 24 Workstation documents.	http://docs.sun.com/app/docs/prod/ultra24
Solaris OS and other software documents. This web site has full search capabilities.	http://docs.sun.com/documentation/
Discussion and troubleshooting forums.	http://supportforum.sun.com/
Support, diagnostic tools, and alerts for all Sun products.	http://www.sun.com/bigadmin/
Links to software patches. Lists some system specifications, troubleshooting and maintenance information, and other tools.	http://www.sunsolve.sun.com/handbook_pub/
Sun service program phone numbers.	1-800-872-4786 (1-800-USA-4Sun); Select Option 1

TABLE 3-2   Sun Web Sites and Telephone Numbers

Workstation Documents and Support Resources	URL or Telephone Number
International telephone numbers for Sun service support.	`http://www.sun.com/service/contacting/solution.html`
Warranty and contract support contacts. Links to other service tools.	`http://www.sun.com/service/warrantiescontracts/index.html`
Warranties for every Sun product.	`http://www.sun.com/service/support/warranty`

CHAPTER **4**

Running Diagnostics

The Pc-Check diagnostics software detects and tests motherboard components, ports, slots, and installed components on the Sun Ultra 24 Workstation. Pc-Check is included on the Sun Ultra 24 Workstation Tools and Drivers DVD.

If you encounter a hardware-related error message (such as a memory error or hard disk error) on your Sun Ultra 24 Workstation, run one of the following tests:

- Advanced Diagnostics Test: Specific hardware component tests
- Immediate Burn In Test: Sun-supplied diagnostic scripts for the Sun Ultra 24 Workstation

The following sections describe how to start and use the diagnostics, and provide detailed descriptions of menu items and tests.

4.1 Understanding the Diagnostic Partition

A diagnostic partition is required for the test scripts to write their log files. Without a diagnostic partition, the only output is the display on the diagnostic screens.

The diagnostic partition is preinstalled on the Sun Ultra 24 Workstation. You do not need to reinstall the diagnostic partition unless you removed it.

If you removed the diagnostic partition, you can re-create it using the Create Diagnostic Partition option on the Tools and Drivers DVD. See Section 4.7, "Create Diagnostic Partition" on page 4-11 for instructions.

4.2 Starting Pc-Check Diagnostics

Prerequisites

- Your workstation must be running a Sun-supported Linux or Solaris™ OS. Refer to the *Sun Ultra 24 Workstation Operating System Installation Guide* for a list of supported operating systems.
- You must access and execute Pc-Check from the Sun Ultra 24 Workstation Tools and Drivers DVD.

To access the Pc-Check Diagnostics main menu:

1. **Insert the Sun Ultra 24 Workstation Tools and Drivers DVD into your DVD drive, and reboot the system.**

   The system boots to the Sun Ultra 24 Workstation Tools and Drivers DVD main menu.

2. **Type 1 to run the Hardware Diagnostics Software.**

   The system information loads, the Diagnostics main menu opens, and the following menu options appear:

   - System Information Menu
   - Advanced Diagnostics Tests
   - Immediate Burn In Testing
   - Deferred Burn In Testing
   - Create Diagnostic Partition
   - Show Results Summary
   - Print Results Report

- About Pc-Check
- Exit to DOS

The entries in the Diagnostics main menu are described in the following sections.

- To test a specific hardware component, choose Advanced Diagnostics Test.
- To run one of the Sun-supplied test scripts, choose Immediate Burn In Testing.

Navigation instructions are shown at the bottom of each screen.

- Use the keyboard's arrow keys to navigate through menus.
- Press the Enter key to choose a menu option.
- Press the Escape key to exit a menu (or submenu).

4.3 System Information Menu

TABLE 4-1 describes each option in the System Information menu.

TABLE 4-1   System Information Menu Options

Option	Description
System Overview	Includes basic information about your system, motherboard, BIOS, processor, memory cache, drives, video, modem, network, buses, and ports.
Hardware ID Image menu	Enables you to create a document showing information about your system, including comparisons between the updates and the newest versions of your system. XML is the format used to create and display this information, though you can also choose a text format (.txt) as well.
System Management Information	Provides information obtained from the system about the BIOS type, system, motherboard, enclosure, processors, memory modules, cache, slots, system event log, memory array, memory devices, memory device mapped addresses, and system boot.
PCI Bus Information	Includes details about specific devices from `pci-config` space within the system, similar to the System Management Information section.
IDE Bus Information	Shows the master-slave devices on the primary and secondary IDE controllers.
PCMCIA/CardBus Info	Not relevant to the Sun Ultra 24 Workstation.
Interrupt Vectors	Details and lists device interrupt vector information.

TABLE 4-1 System Information Menu Options *(Continued)*

Option	Description
IRQ Information	Shows hardware interrupt assignments.
Device Drivers	Shows device drivers loaded under Open DOS.
APM Information	Tests the Advanced Power Management (APM) capabilities of the system. You can choose to change the power state, view the power status, indicate CPU usage, get a PM event, or change the interface mode.
I/O Port Browser	Shows the I/O port assignment for the hardware devices on the system.
Memory Browser	Enables you to view the mapped memory for the entire system.
Sector Browser	Reads sector information from the hard disks and DVD disks sector by sector.
CPU Frequency Monitor	Tests the processor speed.
CMOS RAM Utilities	Shows the CMOS settings of the system.
SCSI Utilities	Not applicable to the Sun Ultra 24 Workstation.
Text File Editor	Opens a text editor.
Start-Up Options	Enables you to set up options for diagnostics testing.

4.4　Advanced Diagnostics

TABLE 4-2 gives the name and a brief description of each option in the Advanced Diagnostics Tests menu.

TABLE 4-2　Advanced Diagnostics Tests Menu Options

Option	Description
Processor	Details information about the processor and includes a Processor Tests menu to test the processor on the system.
Memory	Details information about the memory and includes a Memory Tests menu to test the memory on the system. Also lists each type of memory in the system, such as system, cache, or video memory.
Motherboard	Details information about the motherboard and includes a Motherboard Tests menu to test the motherboard on the system.
Diskettes	Not applicable to the Sun Ultra 24 Workstation.
Hard Disks	Details information about the hard disk and includes a Hard Disk Tests menu to test hard disks on the system. Refer to Section 4.4.1, "Hard Drive Testing" on page 4-6, for detailed information about testing hard disks and script information.
CD-ROM/DVD	Includes a CD-ROM/DVD menu to test DVD devices on the system.
ATAPI Devices	N/A
Serial Ports	Not applicable to the Sun Ultra 24 Workstation.
Parallel Ports	Not applicable to the Sun Ultra 24 Workstation.
Modems	Not applicable to the Sun Ultra 24 Workstation.
ATA	Includes an ATA test menu.
USB	Details information about the USB devices on the system and includes a USB Tests menu to test the USB.
FireWire	Details information about FireWire devices and includes a FireWire tests menu.
Network	Performs network register controller tests.
Keyboard	Includes a Keyboard Test menu with options for performing different tests on the keyboard.

TABLE 4-2 Advanced Diagnostics Tests Menu Options *(Continued)*

Option	Description
Mouse	Details information about the mouse and includes a menu to test the mouse on the system.
Joystick	Provides details information about a third-party joystick (not available from Sun) and includes a menu to test the joystick.
Audio	Details information about the audio devices on the system and includes an Audio Tests menu to test audio device information. A PCI audio card is required to run this test.
Video	Details information about the video card. Initially, the monitor might flicker, but then it displays a Video Test Options menu that enables you to perform various video tests.
Printers	Not applicable to the Sun Ultra 24 Workstation.
Firmware - ACPI	Details information about Advanced Configurable Power Interface (ACPI) and includes an ACPI Tests menu to test ACPI.

4.4.1   Hard Drive Testing

To test the hard drive (HD):

1. **From the Diagnostics main menu, choose Advanced Diagnostics Tests.**

   The Advanced Diagnostics menu appears.

2. **From the Advanced Diagnostics menu, choose Hard Disks.**

   The Select Drive menu appears.

3. **From the Select Drive menu, choose the hard disk you are testing.**

   The Hard Disk Diagnostics window opens, showing both the information for the hard disk you selected and the Hard Disk Tests menu.

   The Hard Disk Tests menu displays the following options:

   - Select Drive
   - Test Settings
   - Read Test
   - Read Verify Test
   - Non-Destructive Write Test
   - Destructive Write Test

- Mechanics Stress Test
- Internal Cache Test
- View Error Log
- Utilities Menu
- Exit

The Hard Disk Tests perform diagnostics on both the media and the device. The media diagnostic options are the Read Test, the Read Verify Test, the Non-Destructive Write Test, and the Destructive Write Test. These tests are relevant to testing the media associated with the HD hardware, such as the physical disk.

Caution – Running the Destructive Write Test destroys any data that is on the HD.

The device diagnostic options include the Mechanics Stress Test and the Internal Cache Test. These tests are relevant to testing nonmedia-related devices associated with the HD hardware, such as the head and internal cache.

If errors occur during diagnostic testing, the errors are written to the error log. You can examine the error log using the View Error Log option.

As well as choosing any of these tests, you can also define several test parameters. You can change the parameters within the Test Settings option. TABLE 4-3 gives the options within Test Settings.

TABLE 4-3   Parameters for the HD Tests

Option	Description
Media Test Settings	Enables you to select the test time duration, the percentage of the hard disk to test, and the sectors to be tested on the hard disk.
Device Test Settings	Enables you to select the test time durations of the devices and the test level.
Number of Retries	Enables you to select the number of times to retry testing a device before terminating the test.
Maximum Errors	Enables you to select the number of errors allowed before terminating the test.
Check SMART First	SMART stands for Smart Monitoring Analysis Reporting Test. SMART-enabled drives provide predictive failure analysis and diagnostic information.
HPA Protection	HPA stands for Host Protected Area.
Exit	Exits the menu.

4.5　Immediate Burn In Testing

The Immediate Burn In Testing option enables you to run Burn In test scripts on your workstation. Three scripts were created for testing your system:

- `quick.tst` – This script performs a non-detailed test of all hardware components, including those components that require user input, as well as a more in-depth memory test. You must interact with the Pc-Check software to progress through these interactive tests. These interactive tests cannot be run unattended and do not contain any "timeout" facilities. The interactive tests will wait until you provide the correct input.

- `noinput.tst` – This script is used as a triage of any hardware-related problems or issues. The script performs a non-detailed test of most hardware components, excluding those components that require user input (keyboard, mouse, sound, video). This test does not require user input.

- `full.tst` – This script performs the most detailed and comprehensive test on all hardware components, including those components which require user input. This script contains a more in-depth memory test than `quick.tst`, as well as external port tests (which might require loopback connectors). You must interact with the test utility to progress through these interactive tests.

Tip – Each of these scripts tests the operating status of your entire system. If you want to test only a certain percentage of your system's hard drives, see Section 4.4.1, "Hard Drive Testing" on page 4-6 for information about how to change the test options.

When you select the Immediate Burn In Testing menu option, the Continuous Burn In Testing window appears. The window includes the list of options shown in TABLE 4-4 for running the tests. When a `quick.tst`, `noinput.tst`, or `full.tst` script is loaded, the defaults indicated in the third column are automatically loaded.

TABLE 4-4 Continuous Burn In Testing Options

Option	Default – General	Default Using `quick.tst`, `noinput.tst`, or `full.tst` Script	All Possible Choices
Pass Control	Overall Time	Overall Passes	Individual Passes, Overall Passes, or Overall Time
Duration	01:00	1	Type any number to choose the time duration of the test
Script File	N/A	`quick.tst`, `noinput.tst`, or `full.tst`	`quick.tst`, `noiniput.tst`, or `full.tst`
Report File	None	None	User-defined
Journal File	None	`D:\noinput.jrl`, `D:\quick.jrl`, or `D:\full.jrl`	User-defined
Journal Options	Failed Tests	All Tests, Absent Devices, and Test Summary	Failed Tests, All Tests, Absent Devices, and Test Summary
Pause on Error	N	N	Y or N
Screen Display	Control Panel	Control Panel	Control Panel or Running Tests
POST Card	N	N	Y or N
Beep Codes	N	N	Y or N
Maximum Fails	Disabled	Disabled	1-9999

To load one of the scripts available to test the devices on your system:

● **From the main menu, choose Immediate Burn In Testing.**

The top portion of the window lists the options described in TABLE 4-4, and the bottom portion of the window lists the following Burn In testing menu options:

■ **Load Burn In Script**

Type one of the following:

quick.tst, **noinput.tst**, or **full.tst**

If you created and saved your own script, type **d:***testname***.tst**

testname   The name of the script that you created.

■ **Save Burn In Script**

To save a Burn In script that you created, type **d:***testname***.tst**

testname   The name of the script that you created.

- **Change Options**

    Opens the Burn In Options menu, which enables you to modify the various options listed in TABLE 4-4 for the currently loaded test script.

- **Select Tests**

    Opens a listing of the tests available for your workstation configuration and the currently loaded test script.

- **Perform Burn In Tests**

    Starts to run the currently loaded Burn In test script.

4.6   Deferred Burn In Testing

You can use the Deferred Burn In Testing option to create and save your own scripts to run at a later time.

- **From the main menu, choose Deferred Burn In Testing.**

    The top portion of the window lists the options described in TABLE 4-4, and the bottom portion of the window lists the following Burn In menu options:

- **Load Burn In Script**

    Type one of the following:

    quick.tst, **noinput.tst**, or **full.tst**

    If you created and saved your own script, type **d:***testname***.tst**

    testname   The name that you created.

- **Save Burn In Script**

    To save a Burn In script that you created, type **d:***testname***.tst**

    testname   The name of the script that you created.

- **Change Options**

    Opens the Burn In Options menu, which enables you to modify the various options listed in TABLE 4-4 for the currently loaded test script.

- **Select Tests**

    Opens a listing of all of the possible types of tests available for you to run for the currently loaded test script.

4.7 Create Diagnostic Partition

The diagnostic partition is preinstalled on the Sun Ultra 24 Workstation. You need to reinstall the diagnostic partition only if you reformatted your hard drive. Using the Erase Primary Boot Hard Disk utility on the Tools and Drivers DVD preserves the diagnostic partition (see the *Sun Ultra 24 Workstation Operating System Installation Guide*).

The Create Diagnostic Partition option installs a diagnostic partition on the first bootable disk seen by the workstation. The first bootable disk is on the primary or master storage (for example, SATA) device.

The following sections explain how to create and access the diagnostic partition on the Sun Ultra 24 Workstation:

- Section 4.7.1, "Adding a Diagnostic Partition to the First Bootable Disk" on page 4-11
- Section 4.7.2, "Creating a Log File on the Diagnostic Partition" on page 4-12
- Section 4.7.3, "Accessing the Diagnostic Partition Under Red Hat Linux" on page 4-13
- Section 4.7.4, "Accessing the Diagnostic Partition Under the Solaris 10 Operating System" on page 4-14
- Section 4.7.5, "Accessing the Diagnostic Partition Under Windows XP" on page 4-15

4.7.1 Adding a Diagnostic Partition to the First Bootable Disk

From the boot loader, Pc-Check can view only the first or second hard disk on the system. The software automatically installs the diagnostic partition on the first bootable disk. To add the diagnostic partition on the first bootable disk:

1. **Insert the Tools and Drivers DVD into the DVD drive.**

2. **Reboot the workstation.**

3. **At the Tools and Drivers DVD main menu, type 1 to run Hardware Diagnostics.**

   The Hardware Diagnostics menu appears.

4. **From the main menu, choose Create Diagnostic Partition.**

   - If the first bootable disk is clear of partitions, the Sun Microsystems Partitioning Utility window appears. It states:

   "Your primary hard disk is not partitioned. Would you like to partition it now?"

   Select Yes, and press the Enter key.

   A window appears stating:

   "Partitioning complete. Your machine will now be restarted."

   - If the first bootable disk is not clear of partitions, a window appears stating that the software is unable to create a hardware diagnostic partition because there are already partitions on the disk.

     If this happens, repeat this procedure after you remove the partitions as described in the *Sun Ultra 24 Workstation Operating System Installation Guide*.

5. **Press the Enter key to reboot your workstation.**

4.7.2   Creating a Log File on the Diagnostic Partition

All the scripts that are loadable with the hardware diagnostics software are predefined with logging to the diagnostic partition enabled. The names of log files correspond to the name of the script. For example, a script named `noinput.tst` creates a log file named `noinput.jrl`.

The following instructions show an example of how to create and access a log file on the diagnostic partition for the `noinput.tst` script.

1. **Insert the Tools and Drivers DVD into the DVD drive.**

2. **Reboot the workstation.**

3. **From the Tools and Drivers DVD main menu, choose 1 to run the Hardware Diagnostics software.**

   The Hardware Diagnostics menu appears.

4. **From the Hardware Diagnostics main menu, choose Immediate Burn In Testing.**

5. **Select Load Burn In Script.**

6. **Do one of the following actions:**

- Type **noinput.tst**, and press the Enter key.

- If you are using a test you created yourself, type **d:**_testname_**.tst** in the Load Burn In Script field. _testname_ is the name of the test you created.

7. **Select Perform Burn In Tests to run the script.**

8. **When the tests are complete, press the Escape key to exit the Display Results window.**

9. **Select Exit to DOS, and press the Enter key.**

10. **At the DOS prompt, type the following:**

    C:> **d:**

11. **Type the following to list the contents of the diagnostic partition.**

    D:> **dir**

    The noinput.jrl log appears.

4.7.3   Accessing the Diagnostic Partition Under Red Hat Linux

Perform this procedure to access the diagnostic partition when you are running a Red Hat Linux OS.

1. **Remove the Tools and Drivers DVD from the DVD drive.**

2. **Reboot the workstation and start the Red Hat Linux OS.**

3. **Log in as superuser.**

4. **To determine whether your diagnostic partition is configured to be mounted, type the following command:**

   # **ls /diagpart**

   - If this command does not list the log files created by the hardware diagnostics software, then the OS was not configured to mount the diagnostic partition. Continue to Step 5.

   - If the command lists the log files created by the hardware diagnostics software, then the OS is configured to mount the diagnostic partition. All users have read access to this partition. Only the superuser has read/write access to this partition. You do not need to continue this procedure.

5. **Insert the Tools and Drivers DVD into the DVD drive.**

6. **When the DVD mounts, open a terminal window.**

7. **Type the following command:**

   # **cd** *mountpoint***/drivers/linux/***linux_version*

   mountpoint   The DVD mountpoint

   linux_version   The version of Linux that you installed. For example:

   # **cd /mnt/cdrom/drivers/linux/red_hat**

8. **Type the following command to install the diagnostic partition:**

   # **./install.sh**

9. **Press the Enter key.**

   The following lines appear if the diagnostic partition is mounted successfully:

   ```
   Mounting Diagnostic Partition
   Installation Successful
   ```

10. **Type the following command:**

    # **ls /diagpart**

    The contents of the diagnostic partition are listed.

4.7.4   Accessing the Diagnostic Partition Under the Solaris 10 Operating System

To access the diagnostic partition when you are running the Solaris 10 Operating System:

1. **Remove the Tools and Drivers DVD from the DVD drive.**

2. **Reboot the machine, and start the Solaris 10 Operating System.**

3. **Log in as superuser.**

4. **Type the following command to determine if your diagnostic partition is configured to be mounted:**

   # **ls /diagpart**

   - If this command does not list the log files created by the hardware diagnostics software, then the OS is not configured to mount the diagnostic partition. Continue to Step 5.

   - If this command lists the log files created by the hardware diagnostics software, then the OS is configured to mount the diagnostic partition. All users have read access to this partition. Only the superuser has read/write access to this partition. You do not need to continue this procedure.

5. **Insert the Tools and Drivers DVD into the DVD drive.**

6. **When the DVD mounts, open a terminal window.**

7. **Type the following to change directories:**

   # **`cd /cdrom/cdrom0/drivers/sx86`**

8. **Type the following command to install the diagnostic partition:**

   # **`./install.sh`**

9. **Press the Enter key.**

   The following lines appear if the diagnostic partition is mounted successfully:

   ```
   Mounting Diagnostic Partition
   Installing Successful
   ```

10. **Type the following command to list the contents of the diagnostic partition:**

    # **`ls /diagpart`**

4.7.5   Accessing the Diagnostic Partition Under Windows XP

If you are running Windows XP on the Sun Ultra 24 Workstation, you cannot access the diagnostic partition using Windows XP.

The only way to retrieve the contents (log files) on the diagnostic partition is to attach a USB diskette drive to the Sun Ultra 24 Workstation and complete the following procedure.

1. **Connect the USB diskette drive to any USB port on the Sun Ultra 24 Workstation.**

2. **Insert the Tools and Drivers DVD into the DVD drive.**

3. **Reboot the workstation.**

4. **At the Tools and Drivers DVD main menu, type 4 to exit to DOS.**

5. **To change to the `d:` drive, enter the following at the DOS command prompt.**

   C:> **`d:`**

6. **Copy the log file to the diskette.**

   For example, to copy a file named `noinput.jrl` to the diskette, enter:

   D:> **`copy d:\noinput.jrl a:\`**

   The journal file is now saved to the diskette in the USB diskette drive.

4.8   Show Results Summary

The summary lists the tests run and shows the results. Pass, Fail, or N/A (not applicable) appears for each option.

TABLE 4-5 lists all possible options that are available with the Tools and Drivers DVD. Some options might not appear when the Show Results Summary appears if they are not applicable to your workstation's configuration.

TABLE 4-5   Show Results Summary

Option	Description
Processor	This section shows the following tests conducted against the processor: Core Processor Tests, AMD 64-Bit Core Tests, Math Co-Processor Tests – Pentium Class FDIV and Pentium Class FIST, MMX Operation, 3DNow! Operation, SSE Instruction Set, SSE2 Instruction Set, and MP Symmetry.
Motherboard	This section shows the following tests conducted against the motherboard: DMA Controller Tests, System Timer Tests, Interrupt Test, Keyboard Controller Tests, PCI Bus Tests, and CMOS RAM/Clock Tests.
Memory, Cache Memory, and Video Memory	This section shows the following tests conducted against the various types of memory: Inversion Test Tree, Progressive Inv. Test, Chaotic Addressing Test, and Block Rotation Test.
Input Device	This section shows the following tests conducted against the input device: Verify Device, Keyboard Repeat, and Keyboard LEDs.
Mouse	This section shows the following tests conducted against the mouse: Buttons, Ballistics, Text Mode Positioning, Text Mode Area Redefine, Graphics Mode Positions, Graphics Area Redefine, and Graphics Cursor Redefine.
Video	This section shows the following tests conducted against the video: Color Purity Test, True Color Test, Alignment Test, LCD Test, and Test Cord Test.

TABLE 4-5   Show Results Summary *(Continued)*

Option	Description
Multimedia	This section shows the following tests conducted against the multimedia components: Internal Speaker Test, FM Synthesizer Test, PCM Sample Test, CD/DVD Drive Read Test, CD/DVD Transfer (KB/Sec), CD/DVD Transfer Rating, CD/DVD Drive Seek Test, CD/DVD Seek Time (ms), CD/DVD Test Disk Read, and CD/DVD Tray Test.
ATAPI Devices	N/A
Hard Disk	This section shows the following tests conducted against the hard disk: Read Test, Read Verify Test, Non-Destructive Write Test, Destructive Write Test, Mechanics Stress Test, and Internal Cache Test.
USB	This section shows the following tests conducted against the USB: Controller Tests and Functional Tests.
Hardware ID	The compare test is used to determine the machine ID for the system. This test is not available for the Sun Ultra 24 Workstation.

4.9   Print Results Report

The Print Results Report option enables you to print the results of the diagnosis of your system. Ensure that your workstation is connected to a printer, and then type the required information to print the results.

4.10   About Pc-Check

The About Pc-Check window includes general information about Pc-Check software, including resident and nonresident components, such as mouse devices.

4.11   Exit to DOS

The Exit to DOS option exits Pc-Check and returns you to the DOS prompt.

Maintaining the Workstation

This chapter provides instructions on how to add, replace, and configure the components in the Sun Ultra 24 Workstation after it is set up. The following sections are included in this chapter:

The following procedures are for replacing customer-replaceable units (CRUs):

The following procedures should be performed only by trained field service technicians:

5.1 Electrostatic Discharge (ESD) Precautions

Electrostatic discharge (ESD) can damage your processor, disk drives, expansion boards, and other components. Always observe the following precautions before you install a system component:

- Do not remove a component from its protective packaging until you are ready to install it.
- Wear a wrist strap and attach it to the system chassis ground or to any metal part of the system before handling components.
- Turn off the power switch on the back of the chassis.

Caution – Do not operate the workstation for more than 10 minutes when the left side access panel is removed. Improper cooling airflow might damage the system's components.

5.2 Opening the Workstation

This section describes how to remove the left side access panel and the front bezel.

5.2.1 Tools and Supplies Needed

- No. 2 Phillips screwdriver
- No. 2 Long Phillips screwdriver (>5 inch)
- Flat-head screwdriver
- Antistatic wrist strap (shipped with every CRU)

5.2.2 Powering Off the System and Removing the Left Side Access Panel

Before you remove, replace, or install any components, perform the following steps.

1. **Power off the system and all the peripherals connected to it.**

2. **Turn the power switch on the back of the chassis to the Off position (0).**

Caution – Failure to properly turn off the system before you start installing components can cause serious component damage.

3. **To maintain system grounding, do not unplug the AC power cord from the back of the system unless the specific procedure instructs you to unplug it.**

4. **Loosen the two captive thumbscrews located on the rear edge of the left side access panel (see** FIGURE 5-1**).**

5. **Slide the access panel approximately 1.5 cm toward the back of the workstation.**

6. **Tilt the top edge of the panel out, then lift the panel upward.**

7. **Carefully set the panel aside.**

FIGURE 5-1 Removing the Side Access Panel
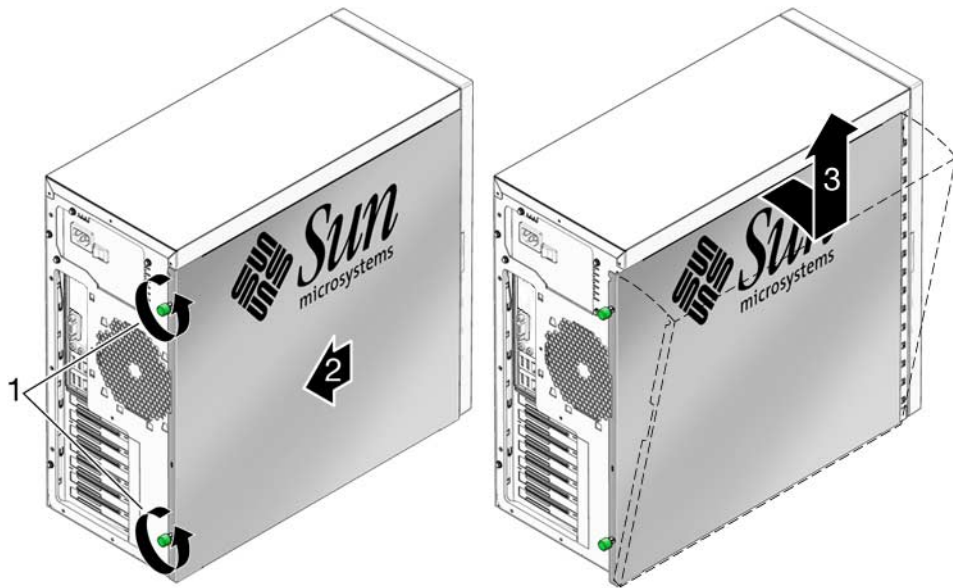
5.2.3   Removing the Front Bezel

Note – Do not remove the front bezel unless removal is required to complete the current maintenance procedure.

To remove the front bezel:

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3.

2. **Unlatch the three left side bezel tabs (see** FIGURE 5-2**) by gently pressing the side of each tab inward and slightly forward.**

   The edge of the bezel nearest the tabs moves slightly away from the front of the chassis as the ridges holding each tab in place are released.

⚠

Caution – Be very careful when pulling the bezel away from the chassis. The bezel tabs and the chassis hooks might break if you apply too much force or attempt to swing the bezel open.

FIGURE 5-2   Removing the Front Bezel
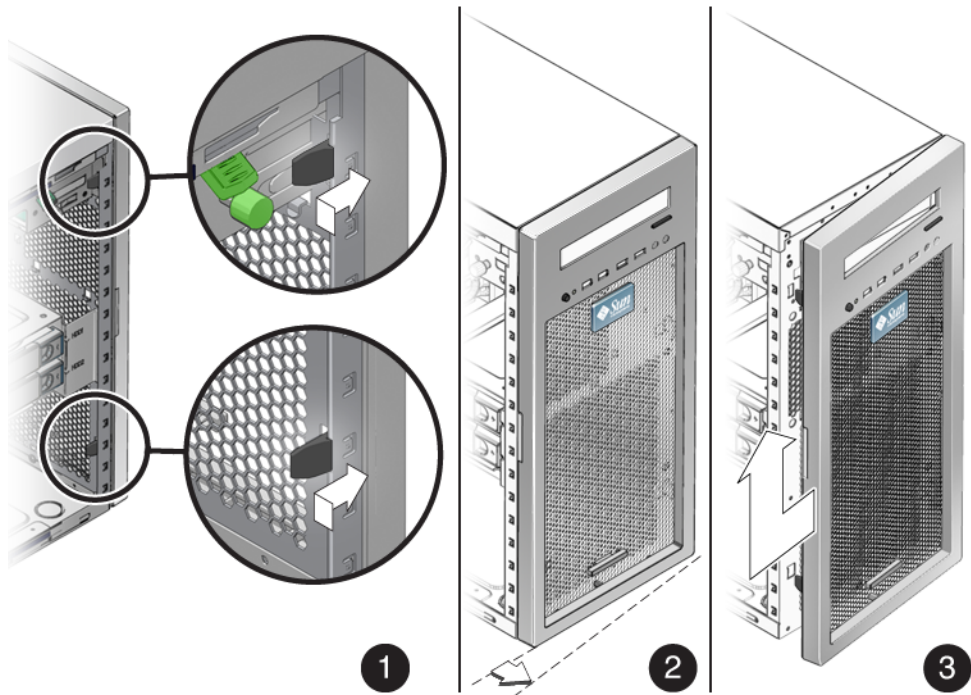
3. **Gently move the left front side of the bezel slightly to the left, then forward to disengage the three chassis hooks on the right side (see** FIGURE 5-2**).**

4. **Remove the bezel and set it aside.**

5.3   Closing the Workstation

This section describes how to install the left side access panel and the front bezel.

5.3.1   Postinstallation Instructions

Perform the following steps after installing a workstation component.

1. **Ensure that all the components are installed as described in the step-by-step instructions.**

2. **Reinstall any PCI cards, PCIe cards, or peripherals that you removed.**

3. **Reinstall the system's front bezel and left side access panel. See the following sections:**

   - Section 5.3.2, "Installing the Front Bezel" on page 5-6.

   - Section 5.3.3, "Installing the Left Side Access Panel" on page 5-7

4. **Connect all external cables to the system, and then connect the AC power cord.**

   See Section 2.3, "Connecting External Devices to the Workstation" on page 2-4.

5. **Power on the system.**

   See Section 2.4, "Powering On the Workstation" on page 2-5.

5.3.2   Installing the Front Bezel

To install the front bezel:

1. **Insert the right side bezel hooks into the right side chassis slots. See** FIGURE 5-3**.**

2. **Insert the left side bezel tabs into the chassis slots, and gently press the left side of the bezel toward the chassis until the tabs lock.**

Caution – Use care when installing the bezel. The bezel tabs and the chassis hooks might break if you apply too much force or attempt to swing the bezel closed.

FIGURE 5-3 Installing the Front Bezel
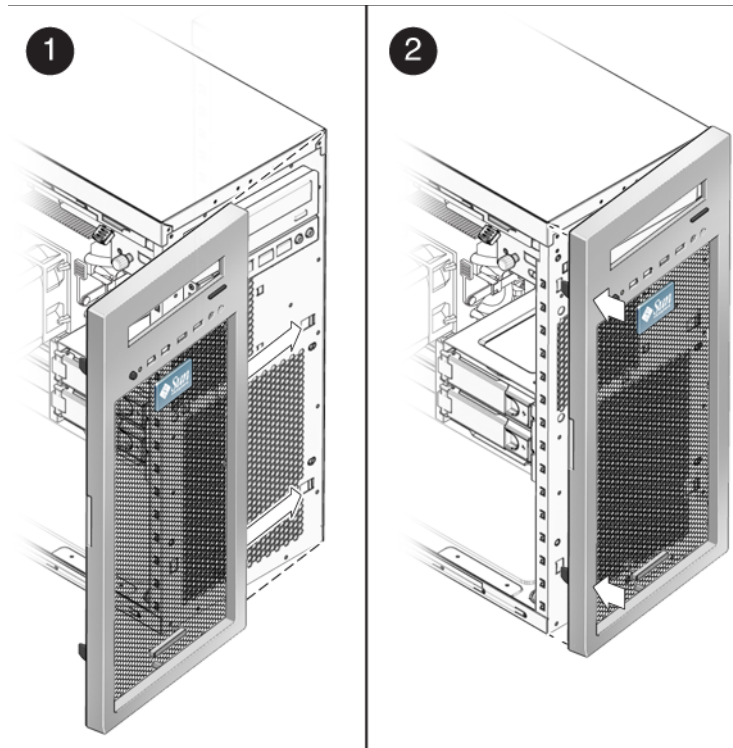
5.3.3 Installing the Left Side Access Panel

Install the left side access panel after you finish inspecting or installing components.

1. **Ensure that all the components are installed as described in the step-by-step instructions for the procedure you are following.**

2. **Reinstall any PCI cards, PCIe cards, or peripherals that you removed.**

3. **Reinstall the front bezel.**

4. **Position the access panel so that the lip on the inside bottom of the panel fits over the bottom chassis rail.**

5. **Pressing gently against the top of the access panel, slide the panel toward the front of the chassis. See** FIGURE 5-4**.**

   The access panel lies flat against the chassis, with no gaps between the two.

6. Tighten the two captive thumbscrews located on the rear lip of the panel.

The access panel is installed flat against the chassis with the thumbscrews tightened.

FIGURE 5-4 Installing the Left Side Access Panel
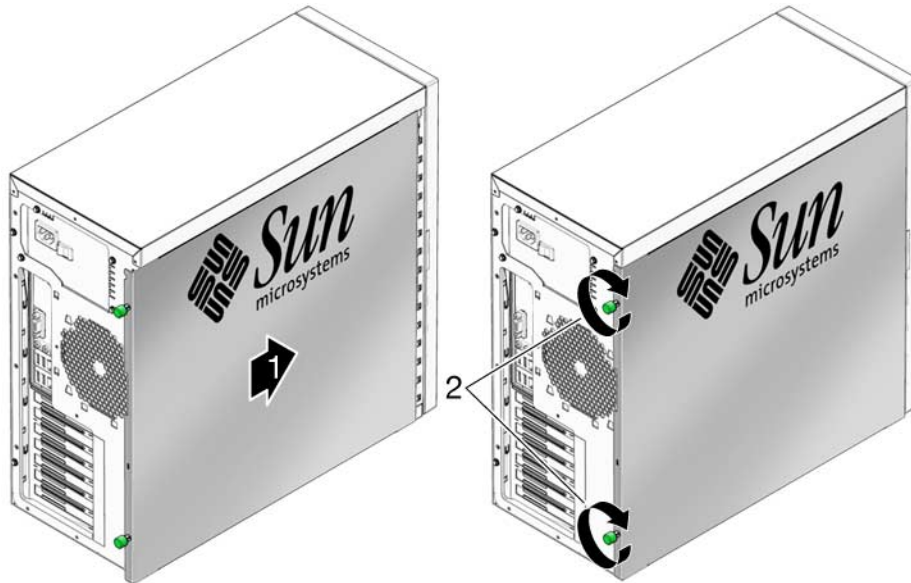
5.4 Removing or Adding a Hard Drive

This section contains procedures to remove and replace a hard drive (HD). Terms used in this section are defined as follows:

- **HD** – A hard drive equipped with rails and a locking mechanism compatible with the HD cage in the Sun Ultra 24 Workstation.

- **HD cage** – The metal assembly that holds the system hard drives. The rails on the Has fit into guides on the HD cage. The HD cage is not replaceable, nor is it removed during maintenance procedures.

- **Storage backplane** – The storage backplane is located beneath the HD cage. When correctly inserted into the HD cage, the HD makes contact with the connectors on the storage backplane. The storage backplane also has cables linking it to the power supply and to storage device connectors on the motherboard.

- **Hard drive assembly** – Installed hard drives, the HD cage, and the storage backplane.

5.4.1 Removing a Hard Drive

Note – The Sun Ultra 24 Workstation accommodates up to four hard drives. If you are not removing an existing HD, proceed to Section 5.4.2, "Installing a Hard Drive" on page 5-11.

To remove an HD:

1. **Follow the instructions in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Locate the HD to be removed.**

4. **Push the plastic latch in the direction of the engraved arrow (away from the metal locking handle) until the HD handle pops out (see** FIGURE 5-5**).**

FIGURE 5-5   Removing a Hard Drive
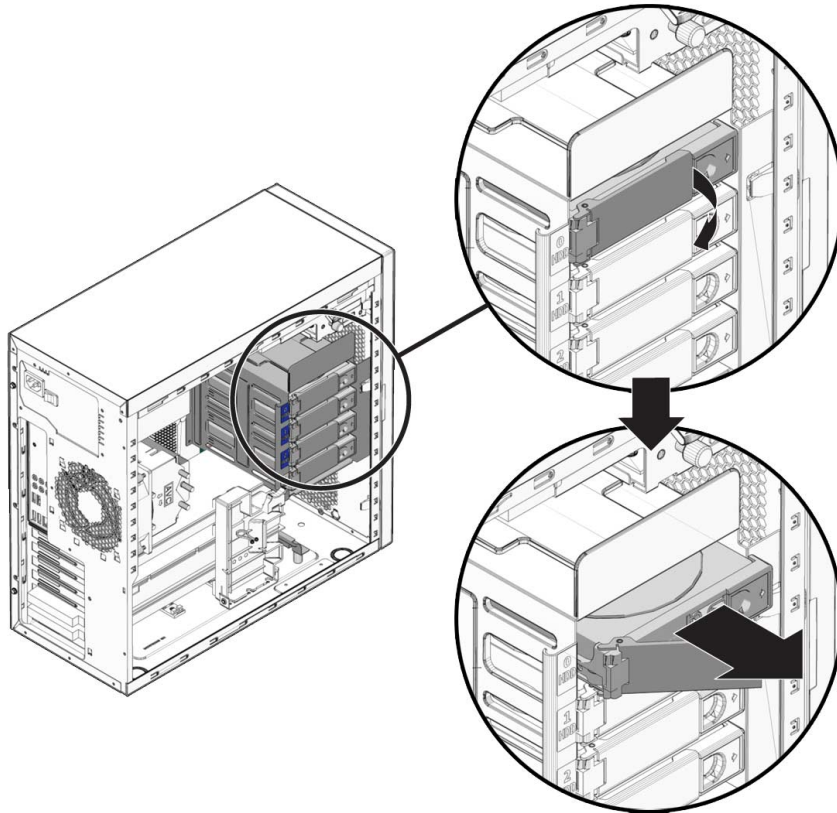
5. **Grasp the HD handle and pull straight up to remove the HD from the system.**

6. **Set the HD on an antistatic surface.**

7. **Choose your next step.**

   - If you removed an HD and want to replace it, see Section 5.4.2, "Installing a Hard Drive" on page 5-11.

   - If you removed an HD and are not replacing it at this time, close the system by performing the steps in Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.4.2   Installing a Hard Drive

To install an HD:

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Remove the new HD from its antistatic packaging.**

Caution – Handle the HD with care. Dropping or jarring the HD can cause damage.

4. **Push the plastic latch in the direction of the engraved arrow (away from the metal handle) until the HD handle pops out.**

FIGURE 5-6   Installing a Hard Drive
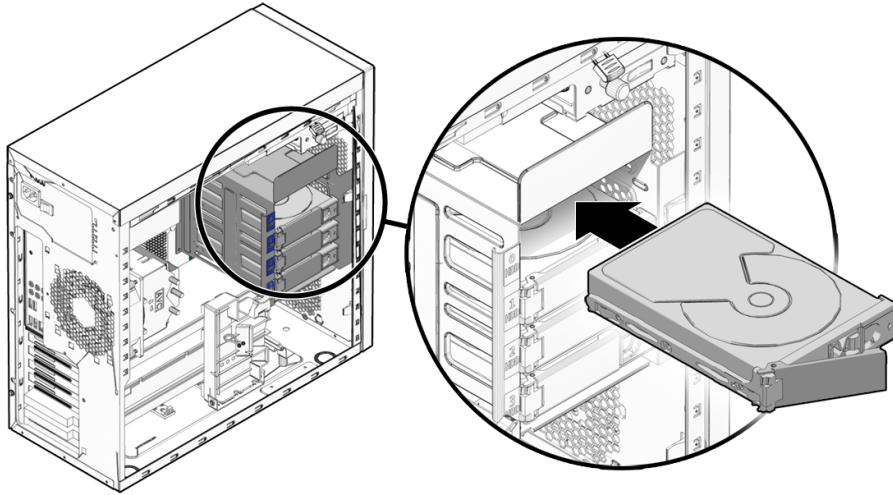
5. **Locate the HD assembly and HD cage guides.**

   You must install a boot drive in HD0, the top slot. Install a second HD in HD1, the second slot. You can install up to four hard drives. The third and fourth HD slots are designated as HD2 and HD3, respectively.

6. **Align the HD so the drive is centered with the HD1 or HD2 indicator on the HD cage. Be sure that the labelled side of the HD faces the top of the system.**

7. **Slide the HD into the HD cage until the metal locking handle begins to close.**

Note – Press on the plastic parts on either side of the metal locking handle to ensure that the handle engages the HD cage.

---

8. **Press the metal locking handle closed until it locks the HD into the HD cage.**

   When correctly installed, the hard drive connector seats firmly into the storage backplane connector.

9. **Inspect the hard drive assembly to verify the following items:**

   - The metal locking handle is fully closed.
   - The HD is seated in the backplane connector.

10. **To close the system, perform the steps in**

5.5   Installing SAS Card, Cables, and Hard Drives

To replace the SATA drives with SAS drives, use the following procedure. You will need to order a SAS installation kit that includes a SAS PCIe card, and SAS hard drives.

To modify the current installation and install the SAS components:

1. **Power off the system, open and position the chassis, and remove the access panel.**

   See

2. **Remove the SATA hard drives from the drive bay.**

   See

3. **Move the HD cables from the motherboard to the SAS card as follows:**

   a. **Release the HD cables from the tiedowns (two places).**

   b. **Disconnect the SATA1 (black connector) cable from the motherboard SATA1 connector, and install it on PHY0 of the SAS card.**

   c. **Disconnect the SATA2 (blue connector) cable from the motherboard SATA2 connector, and install it on PHY1 of the SAS card.**

   d. **Disconnect the SATA3 (green connector) cable from the motherboard SATA3 connector and install it on PHY2 of the SAS card.**

   e. **Disconnect the SATA4 (red connector) cable from the motherboard SATA4 connector and install it on PHY3 of the SAS card.**

Note – To ease the installation process, connect the cables to the SAS before inserting the card in the PCI slot.

4. **Locate the PCIe-3 slot.**

   You must install the SAS card in the PCIe-3 slot. The PCIe-3 slot is the bottom x8 slot.

   See FIGURE 5-7 for PCI card locations.

5. **Using a No. 2 Phillips screwdriver, remove the chassis filler panel from the PCI card slot.**

   See FIGURE 5-18. Save the screw for the next step.

6. **Insert the SAS card into the PCIe card slot, and secure the card with a screw.**

   See FIGURE 5-7.

7. **To keep the cables out of the air stream, carefully secure them in the tie-downs.**

FIGURE 5-7   Installing a SAS Card
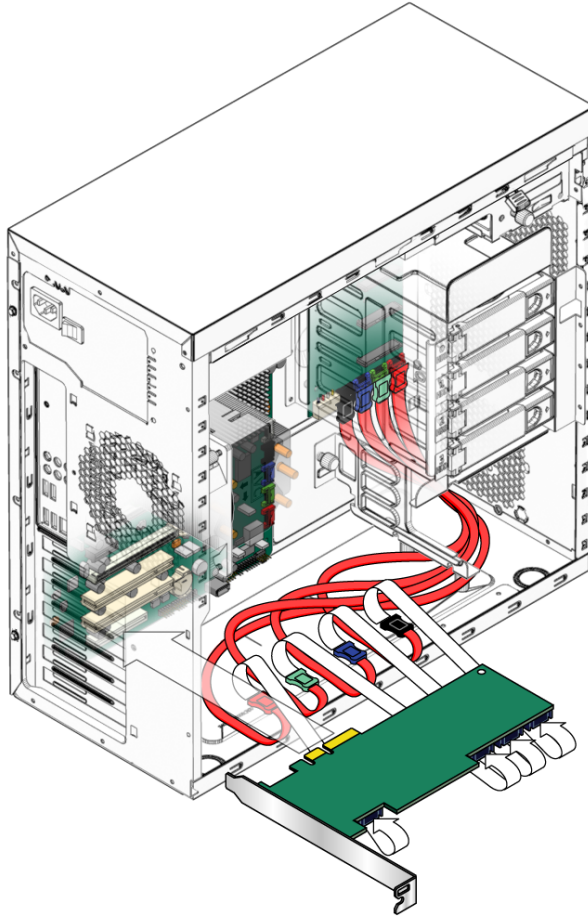
8. **Install the SAS drives.**

   See Section 5.4.2, "Installing a Hard Drive" on page 5-11.

9. **If you are finished working, reinstall the access panel, power on the system, and verify the installation.**

   See Section 5.3.3, "Installing the Left Side Access Panel" on page 5-7.

10. **Install a new operating system for the new SAS configuration.**

   Refer to the *Sun Ultra 24 Workstation Operating System Installation Guide* at:

   http://www.docs.sun.com/

Note – Installing a new operating system is necessary only if your SAS drive does not contain a preinstalled OS.

5.6 Replacing the Storage Backplane

This section describes how to remove and install the storage backplane. For a definition of terms used in this section, see Section 5.4, "Removing or Adding a Hard Drive" on page 5-9.

5.6.1 Removing the Storage Backplane

To remove the storage backplane:

1. **Follow the instructions in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Locate the HD assembly (see** FIGURE 5-8**).**

FIGURE 5-8 Location of the Storage Backplane
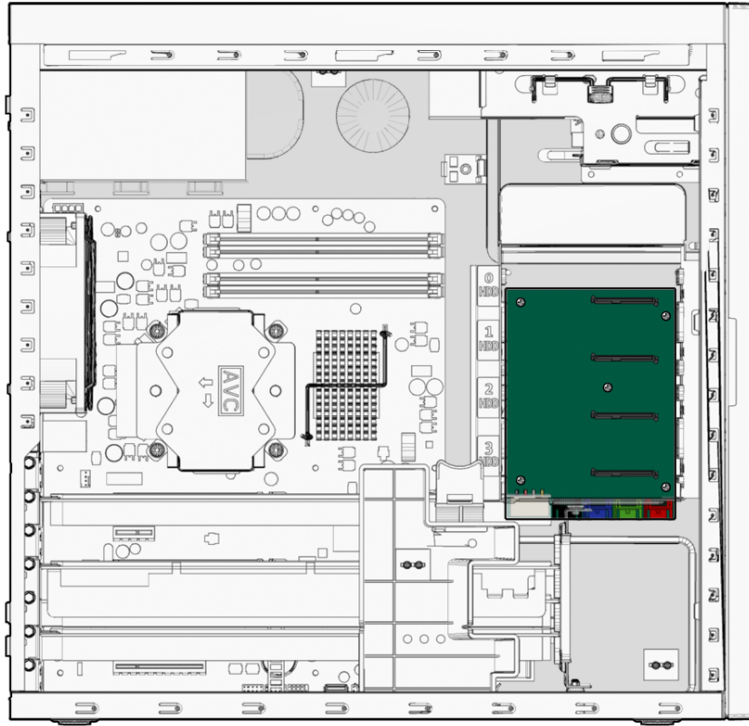
4. **Remove any installed hard drives, and place them on an antistatic surface.**

   See Section 5.4.1, "Removing a Hard Drive" on page 5-9.

5. **Disconnect the power and storage interface cables (see** FIGURE 5-9**).**

FIGURE 5-9   Removing the Storage Backplane
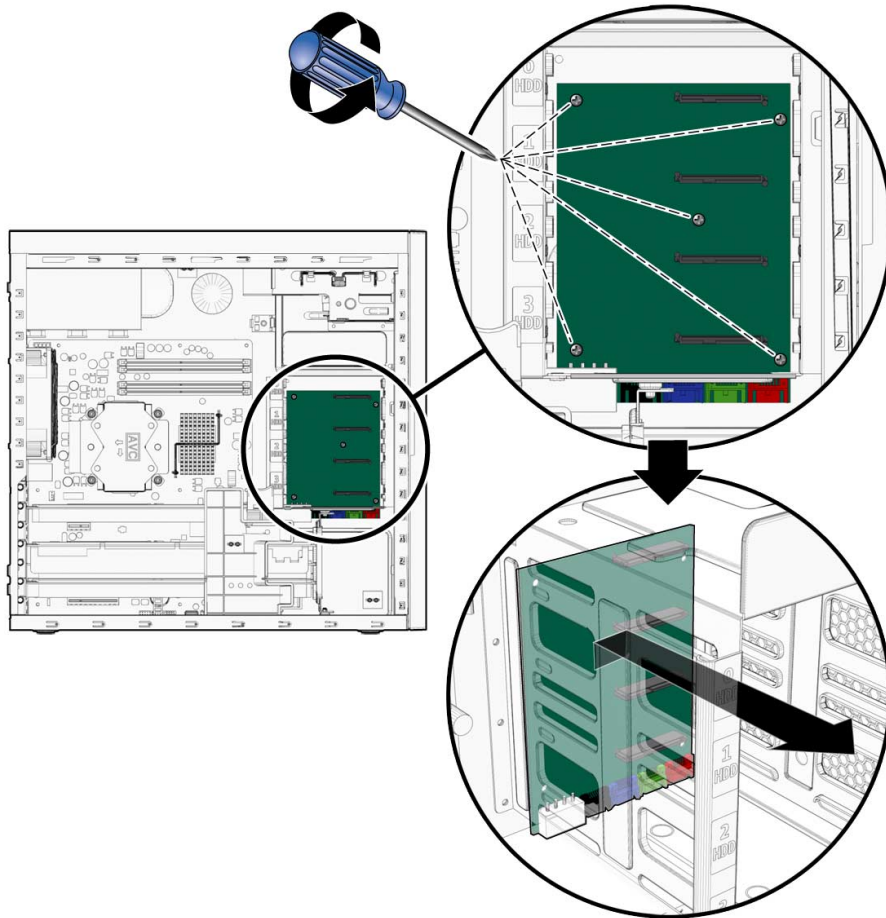
6. **Using a No. 2 Phillips screwdriver, remove the five screws securing the storage backplane to the chassis. Set the screws aside for later use (see** FIGURE 5-9**).**

Note – Do not attempt to remove the HD cage.

---

7. **Remove the storage backplane by pulling it up through the storage cage.**

8. **Proceed to** Section 5.6.2, "Installing the Storage Backplane" on page 5-18 **to install the new storage backplane.**

5.6.2 Installing the Storage Backplane

To install a storage backplane:

1. **Ensure that the power switch on the back panel is in the Off position (0), and that the system is lying on its side with the left side access panel removed.**

2. **Remove the new storage backplane from its packaging.**

3. **Set the storage backplane under the storage cage.**

   Position the screw holes over the holes in the chassis.

FIGURE 5-10 Installing the Storage Backplane
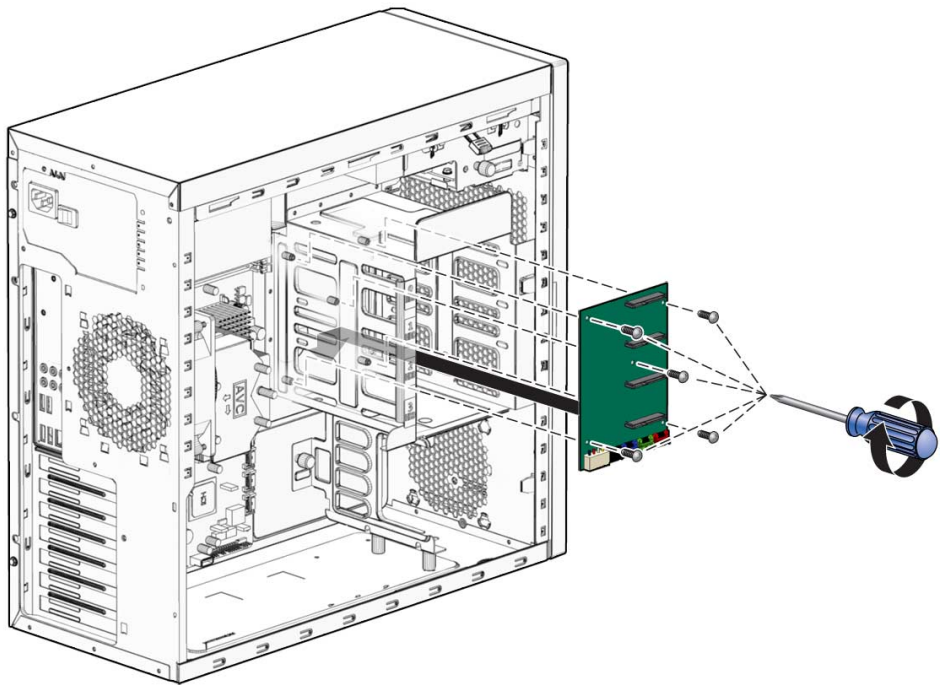
4. **Fasten the storage backplane to the hard drive cage.**

   Using a No. 2 Phillips screwdriver, install the four screws to secure the storage backplane to the hard drive cage. Torque the screws to 8 to 9 inch-pounds.

5. **Connect and route the cables (see FIGURE 5-10).**

   a. **Connect the storage interface cables to the storage backplane connector.**

b. Connect the power supply power cable to disk backplane power connector.

   Refer to the cabling diagram in the service label on the side of the chassis for information about cable routing.

6. **Install all hard drives into the hard drive cage.**

   See Section 5.4.2, "Installing a Hard Drive" on page 5-11.

7. **Inspect the storage backplane, cables, and installed hard drives.**

   - Be sure that the power cable is seated in the storage backplane.

   - Be sure that the storage interface cables are seated in the storage backplane connectors.

8. **To close the system, perform the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5**.**

5.7 Replacing the DVD Drive

This section describes the procedures to remove and replace the DVD drive.

5.7.1 Removing the DVD Drive

To remove the DVD drive:

1. **Remove any media in the DVD drive.**

2. **Follow the instructions in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

3. **Remove the front bezel (see** Section 5.2.3, "Removing the Front Bezel" on page 5-4**).**

4. **Disconnect the cables from the back of the DVD drive (see** FIGURE 5-11**.**

FIGURE 5-11 Location of DVD Cables.
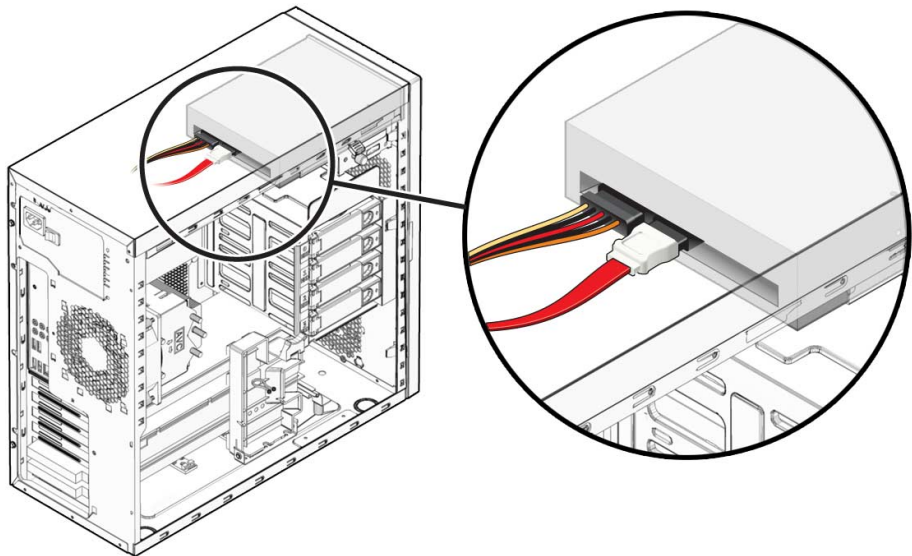
5. **Push the drive retaining lever tab up to release the retaining hooks (see** FIGURE 5-12**).**

FIGURE 5-12 Removing the DVD Drive

6. **Gently pull out the DVD drive from the front of the chassis.**

7. **Place the DVD drive on an antistatic surface.**

8. **Install the new DVD drive as shown in** Section 5.7.2, "Installing the DVD Drive" on page 5-22**.**

5.7.2   Installing the DVD Drive

To install the DVD drive:

1. **Follow the instructions in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Remove the new DVD drive from its packaging.**

3. **Lifting the front end slightly, slide the 5.25-inch DVD drive into the drive bay until the holes on the side align with the hooks on the drive retaining lever.**

FIGURE 5-13 Installing the DVD Drive
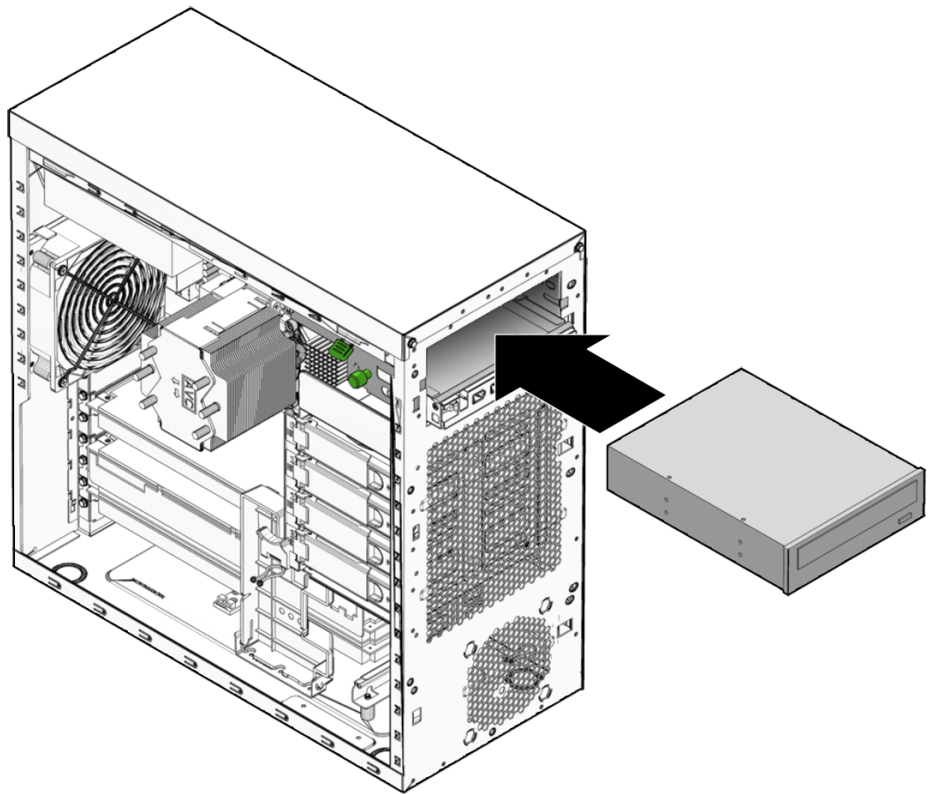
4. **To lock the drive in the drive bay, rotate the drive retaining lever downward.**

5. **Verify that the drive is captured by the retaining hooks.**

6. **Connect the SATA, power, and jumper cables to the back of the DVD drive (see** FIGURE 5-11**).**

   Refer to the cabling diagram in the service label on the side of the chassis for information about correct cable routing.

7. **Replace the front bezel and left side cover of the workstation.**

8. **To close the system, perform the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5**.**

5.8 Removing or Installing DIMMs

This section contains instructions for removing and installing a dual inline memory module (DIMM).

Caution – DIMMs are sensitive to ESD. Be especially careful to follow ESD precautions when changing DIMMs (see Section 5.1, "Electrostatic Discharge (ESD) Precautions" on page 5-2).
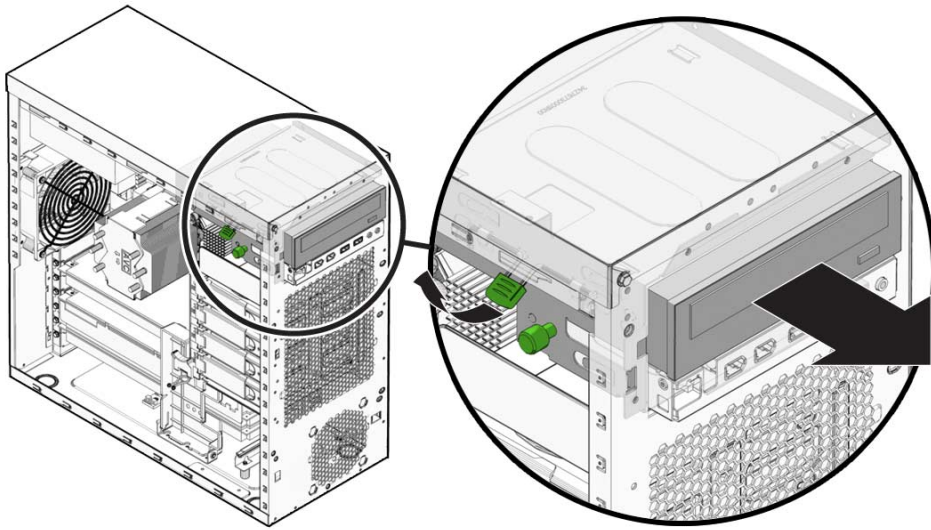
5.8.1 Removing DIMMs

To remove a DIMM:

1. **Follow the instructions in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Identify the location from which you will remove a DIMM (for DIMM location, see** Section 1.3, "Internal Components and Cables" on page 1-4**).**

4. **Place your forefingers on the top of the DIMM.**

5. **Remove the DIMM by pressing down on the ejector bars at both ends of the DIMM socket (**FIGURE 5-14**).**

FIGURE 5-14 Removing a DIMM

6. **Set the DIMM aside on an antistatic surface.**

7. **Choose the next step.**

    ■ If you are installing a new DIMM, see Section 5.8.2, "Installing DIMMs" on page 5-24.

    ■ If you are finished, replace the left side access panel.

5.8.2   Installing DIMMs

When you install a DIMM in the workstation, keep the following guidelines in mind:

■ DIMM slots are numbered 0 to 3. Slot 0 is closest to the CPU

■ DIMMs must be installed and removed in pairs

■ Populate DIMM slot 1 and DIMM slot 3, then DIMM slot 0 and DIMM slot 2

■ For a single DIMM configuration use DIMM slot 1
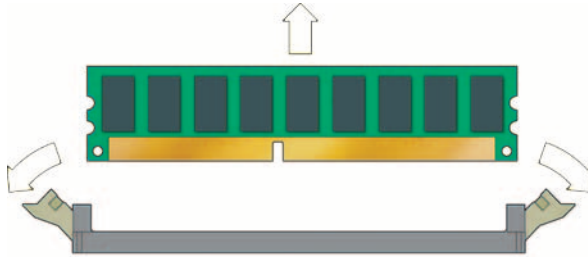
To install DIMMs:

1. **Follow the instructions in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Identify the location into which you will install a DIMM.**

4. **Align the DIMM with the proper slot.**

Note – Be sure to align the notch in the DIMM with the notch in the connector.

---

5. **Insert the DIMM into the slot.**

   Using both thumbs, press the DIMM straight down into the DIMM slot until both ejector levers click, locking the DIMM in the DIMM slot.

   Insert DIMMs evenly, pressing straight down along the DIMM slot until they are locked into place.

   The DIMM is seated when you hear a click and the DIMM ejector levers are in the vertical position.

FIGURE 5-15 Installing a DIMM
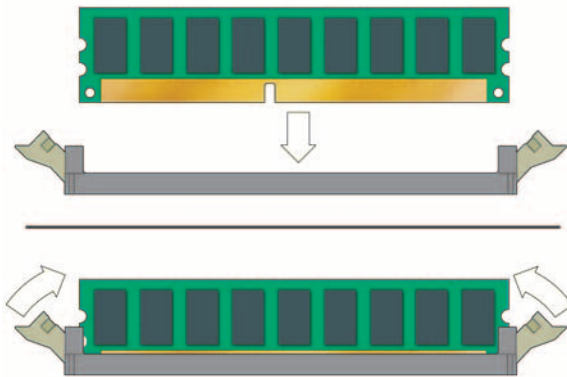
6. **Repeat** Step 3 **through** Step 5 **for each DIMM that you want to replace.**

7. **To close the system, perform the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.8.3 Reconfiguring the System Memory

The system automatically detects the amount of memory installed. Run the BIOS setup to view the new value for total system memory, and make a note of it.

5.9 Removing and Installing a PCIe Card

This section describes how to remove and install a PCI Express (PCIe) card.

For information about how to remove and replace PCI cards, see Section 5.10, "Removing and Installing PCI Cards" on page 5-29.

5.9.1 Removing a PCIe Card

To remove a PCIe card:

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Remove any cables connected to the card.**

4. Unfasten and open the PCIe card retainer (see FIGURE 5-16**).**

FIGURE 5-16 Removing a PCIe Graphics Card
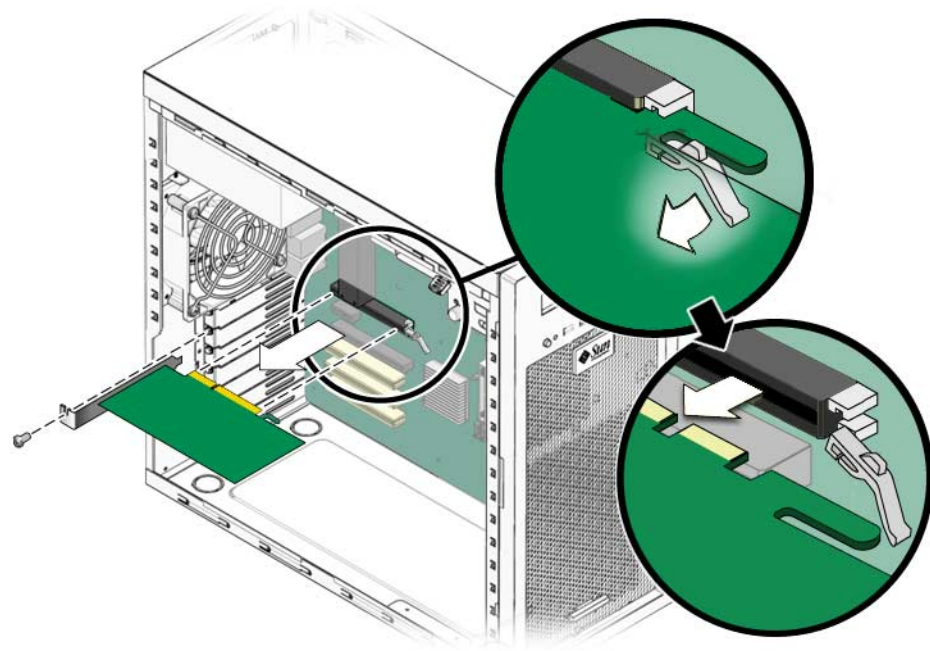
5. Remove the PCIe card.

Gently rock the card forward, and then lift it straight out of the card slot and set it aside on an antistatic surface.

6. Choose your next step.

- If you are replacing the card, follow the instructions in Section 5.9.2, "Installing a PCIe Card" on page 5-28.
- If you are not replacing the graphics card, replace the slot filler panel, and then close the system by performing the steps in Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.9.2 Installing a PCIe Card

Note – See Section 1.3, "Internal Components and Cables" on page 1-4 for PCIe slot locations and to Section A.2.1, "PCIe and PCI Expansion Slots" on page A-4, for slot specifications.

To install a card into a PCIe slot:

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Refer to the service label on the inside of the access panel to help you choose an empty card slot that is compatible with the card that you are installing.**

4. **Remove the metal bracket cover for the slot from the back panel.**

5. **Remove the card from its protective packaging, and lay the card on an antistatic surface until you are ready to install it.**

6. **Position the card in the selected slot. Ensure that the notch on the bottom right corner of the card engages the latch on the motherboard. (The middle PCIe slot does not have a latch.) See** FIGURE 5-17**.**

7. **Press down on the card until it is completely seated in the slot.**

8. **If you are installing a graphics card that requires supplemental power, connect the graphics power cable to the connector on the card.**

   This might require moving the cable out of its cable tie.

FIGURE 5-17 Installing a PCIe Graphics Card
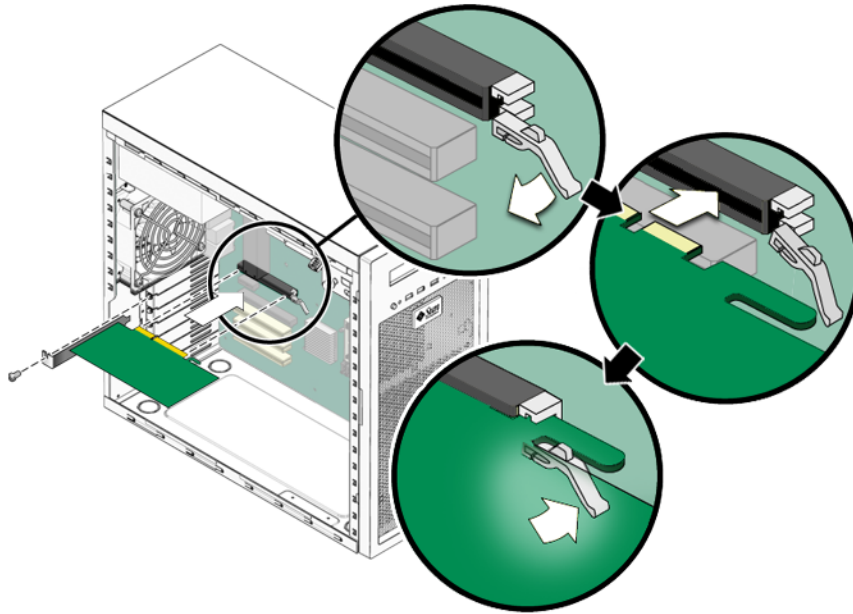
9. **Fasten the retaining screw into place. Torque the screws to 8 to 9 inch-pounds.**

10. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5**.**

5.10   Removing and Installing PCI Cards

This section describes removing and installing standard PCI cards.

For information about how to remove and replace PCIe cards, see Section 5.9, "Removing and Installing a PCIe Card" on page 5-26.

5.10.1   Removing a PCI Card

This procedure describes how to remove a typical PCI card (including a host bus adapter). PCI cards might vary in the way in they are installed in the system.

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Remove any cables connected to the card.**

4. **Unscrew the PCI card retainer screw** (see FIGURE 5-18*).*

5. **Remove the PCI card.**

   Gently rock the PCI card forward, and then lift it straight out of the PCI card slot and set it aside on an antistatic surface.

FIGURE 5-18 Removing a PCI Card
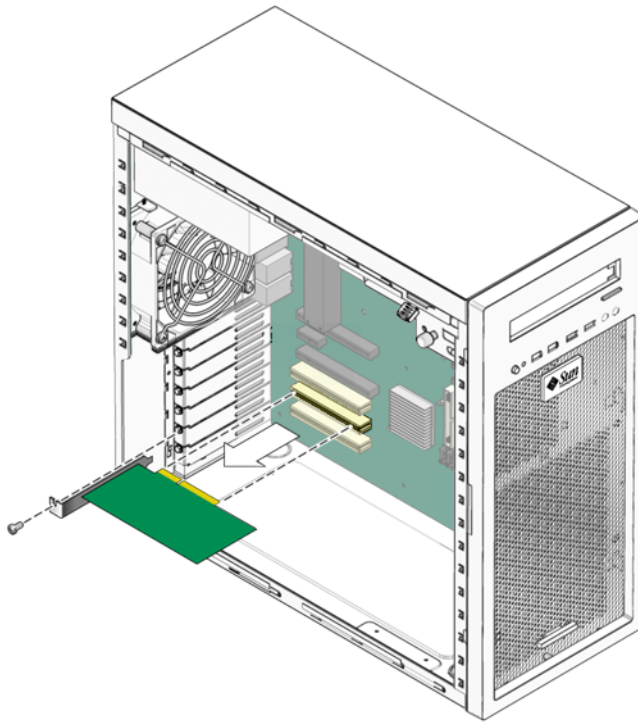
6. **Choose your next step:**

   - If you are not replacing the PCI card, replace the slot filler panel, and then close the system by performing the steps in Section 5.3.1, "Postinstallation Instructions" on page 5-5.

   - If you are replacing the card, follow the instructions in Section 5.10.2, "Installing a PCI Card" on page 5-31.

5.10.2   Installing a PCI Card

Note – Any 64-bit PCI cards that you install will run in 32-bit mode.

To install a PCI card:

Note – See Section 1.3, "Internal Components and Cables" on page 1-4 for PCI slot locations and to Section A.2.1, "PCIe and PCI Expansion Slots" on page A-4, for slot specifications.

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **See the service label on the access panel to determine a slot that is compatible with the card you are installing.**

4. **Remove the metal bracket cover for the slot from the back panel.**

5. **Remove the PCI card from its protective packaging, and lay the card on an antistatic surface until you are ready to install it.**

6. **Position the card over the selected slot (see** FIGURE 5-19**).**

FIGURE 5-19 Installing a PCI card
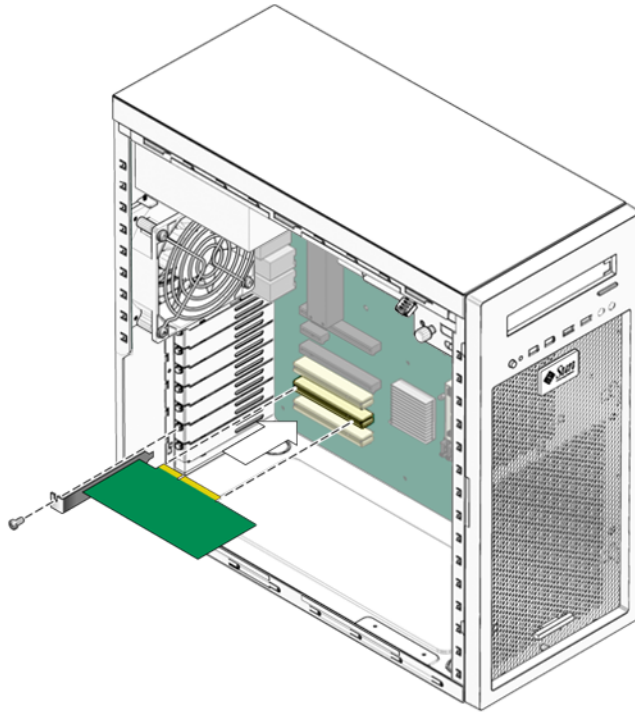
7. **Press down on the card until it is completely seated in the slot.**

8. **Fasten the retaining screw into place. Torque the screws to 8 to 9 inch-pounds.**

9. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.11 Replacing the System Battery

The battery specifications for the Sun Ultra 24 Workstation are shown in TABLE 5-1.

TABLE 5-1   Battery Specifications

Specification	Value
Voltage	3 VDC
Type	CR 2032

To remove and replace the system battery:

⚠ **Caution –** If you remove the system battery, you could erase all system-specific information saved in the CMOS.

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Pinch the battery latch together (squeezing away from the battery) until the battery pops out of the motherboard socket (see** FIGURE 5-20**).**

4. Lift the battery to remove it (see FIGURE 5-20**).**

FIGURE 5-20 Removing the System Battery
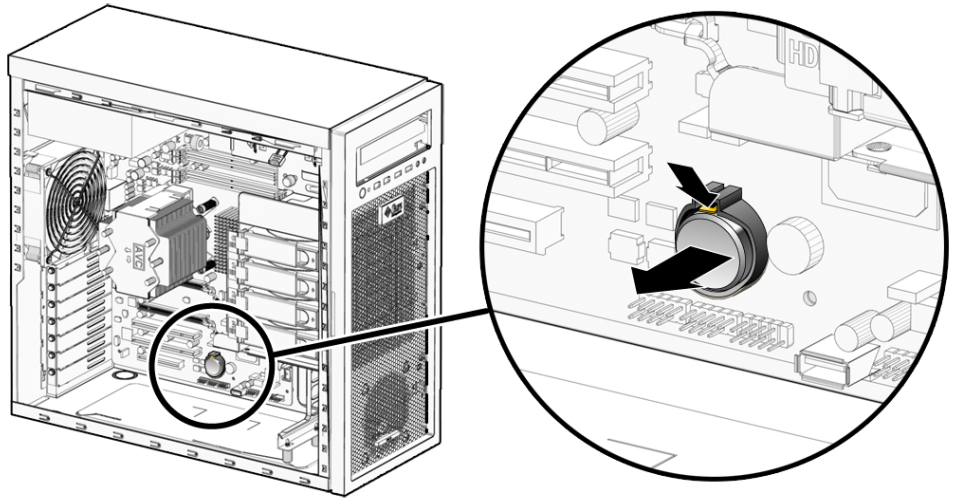
5. Install the new battery with the positive sign (+) facing up (see FIGURE 5-21**).**

Tilt the battery into the battery connector, angling the battery under the battery latch. Slide the battery until it clicks into place.

FIGURE 5-21 Installing a System Battery
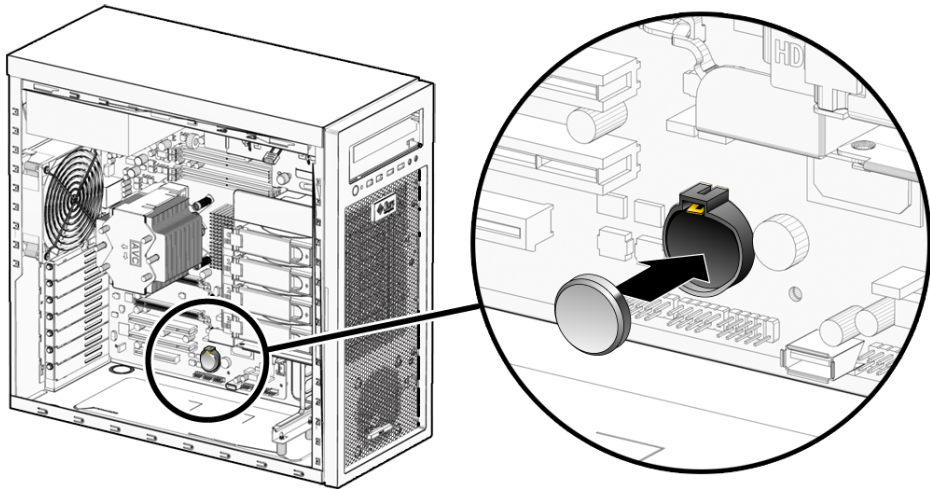
6. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.12 Replacing the System Fan

To replace the system fan:

1. **Follow the steps in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Locate the system fan on the back inside panel of the workstation.**

3. **Disconnect the system fan's power connector from the SYS_FAN connector on the motherboard.**

   To locate the SYS_FAN connector, refer to the service label on the left side access panel or to Section 1.3, "Internal Components and Cables" on page 1-4.

4. **Release the fan's power cord from the cable management strap.**

5. **Gently lift the two latches on the bottom of the fan bracket until the latches clear the chassis.**

6. **Slide the fan assembly down to release the four hooks on the back of the bracket from the holes in the chassis (see** FIGURE 5-22**).**

FIGURE 5-22 Removing the System Fan
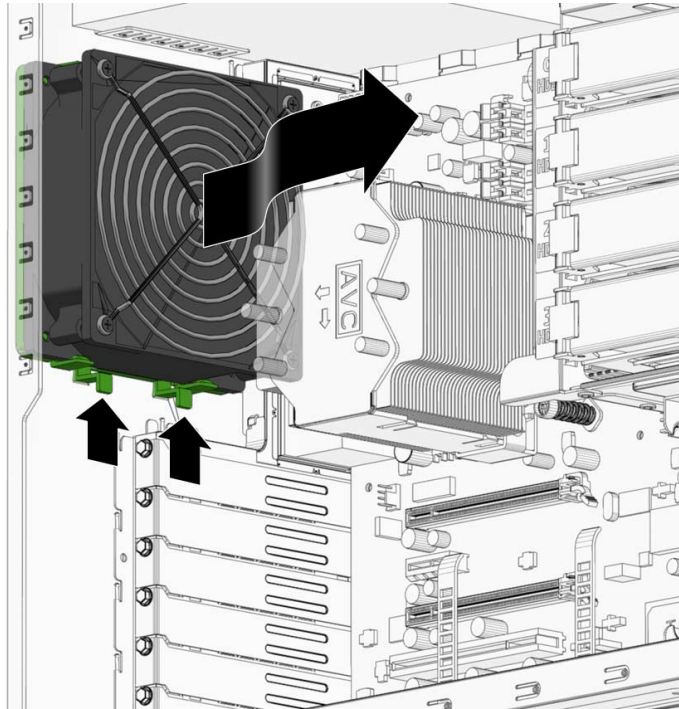
7. **Pull the fan away from the chassis.**

8. **Remove the new fan from its package.**

9. **Locate the four corner holes in the chassis grill where the fan tabs are installed.**

10. **Gently press the fan against the chassis, with the four hooks on the back of the fan bracket in the corner holes on the chassis grill.**

11. **Slide the fan up until the latches click into their locked position (see FIGURE 5-23).**

FIGURE 5-23 Installing the System Fan
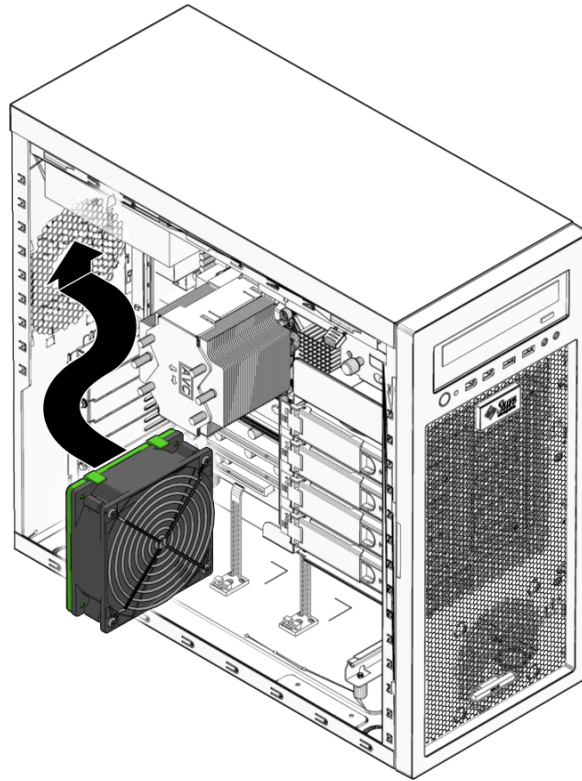
12. **Route the fan's power cord through the cable management strap near the top right corner of the motherboard.**

13. **Connect the fan cable to the SYS_FAN connector on the motherboard.**

14. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.13 Replacing the Power Supply

This section describes removing and installing the power supply.

5.13.1 Removing the Power Supply

To remove the power supply:

1. **Follow the steps in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3.

2. **Unplug the AC power cord from the system.**

3. **Gently lay the system on its right side on a stable, nonslip surface.**

4. **Locate the power supply (see** FIGURE 5-24**).**

FIGURE 5-24 Location of the Power Supply
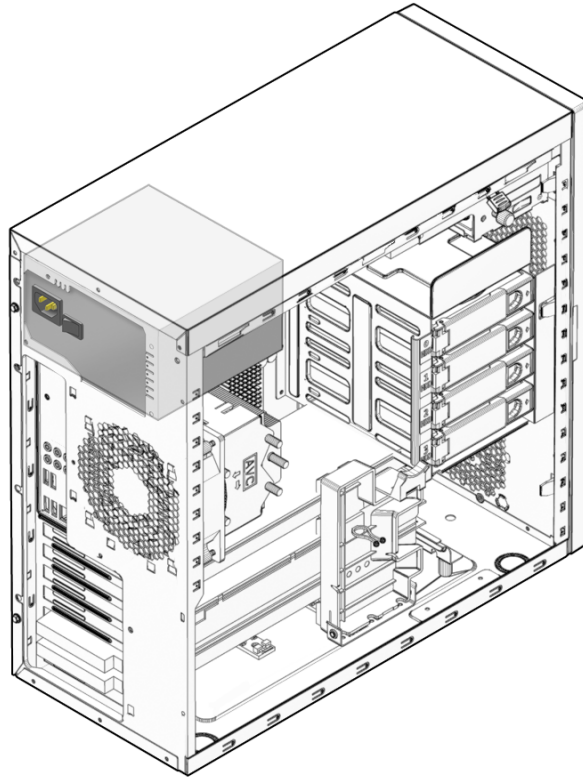
5. **Unfasten the connectors from the motherboard, and release the cable management straps.**

6. **Unfasten the power connectors attached to the motherboard, DVD drive, and storage backplane (see** FIGURE 5-25**).**

FIGURE 5-25   Locations of Power Supply Connections on the Motherboard
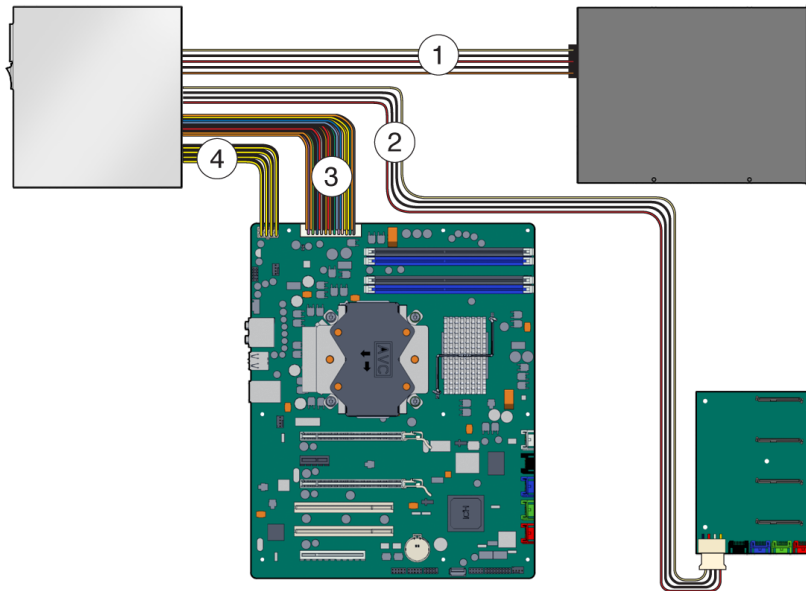
Figure Legend

1	DVD Drive
2	Storage backplane
3	Motherboard PWR1
4	Motherboard PWR2

7. **While supporting the power supply, unfasten the four mounting screws (see** FIGURE 5-26**).**

8. **Remove the power supply from the interior of the system chassis.**

FIGURE 5-26   Removing the Power Supply From the Chassis
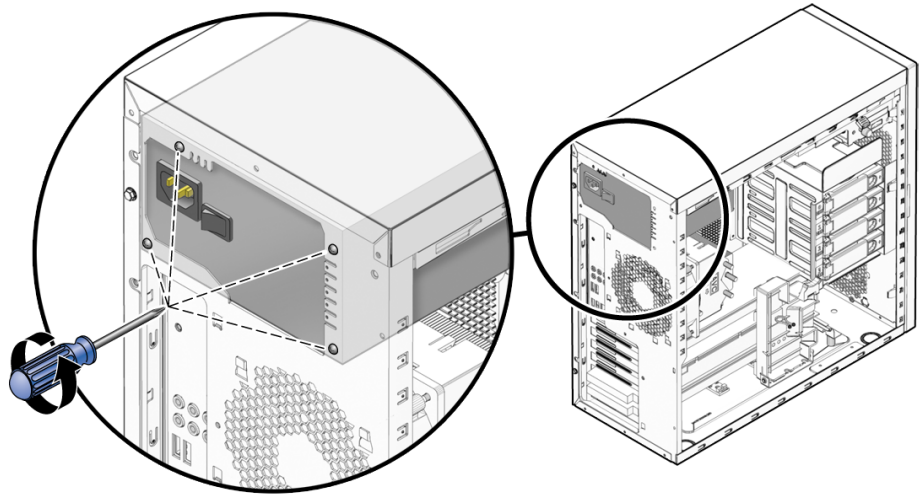
9. **Install the new power supply as shown as** Section 5.13.2, "Installing the Power Supply" on page 5-43.

5.13.2   Installing the Power Supply

To install the power supply:

1. **Remove the new power supply from its package.**

2. **Locate where the power supply is to be installed, then place the power supply inside the chassis (see** FIGURE 5-27**).**

   a. **Align the power supply IEC-320 connector (power cord socket) and fan with the chassis back panel opening.**

   b. **Position the power supply with the chassis power supply brackets.**

   c. **Rotate the power supply down and into the chassis.**

FIGURE 5-27 Installing the Power Supply in the Chassis
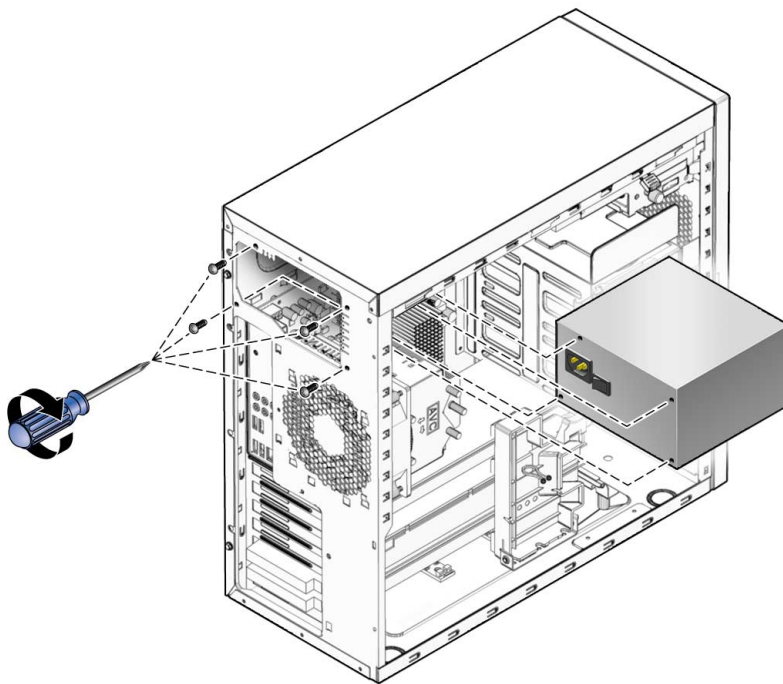
3. **Fasten the four mounting screws on the back of the chassis to secure the power supply to the chassis.**

4. **Reconnect the power supply cables (see** FIGURE 5-25**), and then secure them with the cable management straps.**

Caution – When you connect the power supply cables, make sure that the cables do not interfere with the DIMMs. If the cables push against the DIMMs, the DIMMs might loosen from their connectors.

5. **Verify that the four mounting screws are secure, that all cables are reconnected, and that the cables are secured by the cable management straps.**

6. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5**.**

5.14   Replacing the I/O Board Assembly

The I/O board assembly sits beneath the DVD drive and contains the power switch, Power LED, and external connectors for the front panel.

5.14.1   Removing the I/O Board Assembly

To remove the I/O board assembly.

1. **Follow the steps in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Disconnect any audio, USB, and IEEE 1394 cables connected to the front of the workstation.**

3. **Remove the front bezel (see** Section 5.2.3, "Removing the Front Bezel" on page 5-4**).**

4. **Locate the back of the I/O board assembly within the workstation.**

5. **Disconnect all cables on the back of the I/O board.**

6. **Loosen the captive screw securing the I/O board to the metal frame (see** **).**

FIGURE 5-28 Removing the I/O Board Assembly
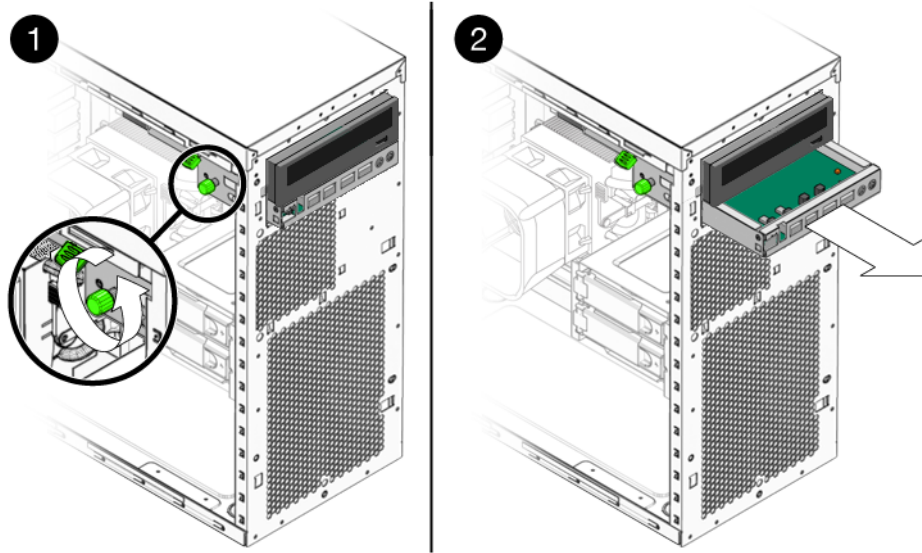
7. **Push the I/O board out the front of the chassis.**

8. **Install the new I/O board assembly as shown in** **.**

5.14.2   Installing the I/O Board Assembly

To install the I/O board assembly:

1. **If necessary perform the steps in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Place the system unit on a flat, stable surface.**

3. **Push the I/O board through the back of the metal I/O board frame until the front panel is flush with the bezel opening (see** FIGURE 5-29**). Wiggle it side to side if the board binds as you install it.**

FIGURE 5-29 Installing the I/O Board Assembly
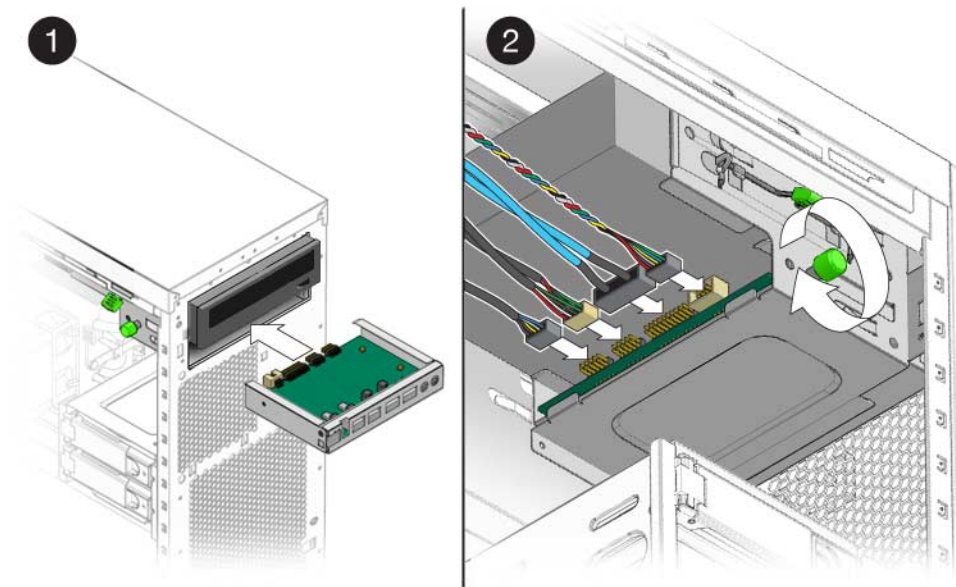
4. **Tighten the captive screw on the metal I/O board frame to secure the I/O board.**

5. **Connect the internal USB, Power LED, IEEE 1394, and audio cables to the back of the I/O board.**

   The cables are color coded and keyed to ensure correct installation. See FIGURE 1-5 and the service label on the chassis cover for the locations of the I/O board connections.

6. **Replace the front bezel.**

7. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.15 Replacing System Cables

The following system cables have a connector at each end and can be removed or installed by the customer. All other cables are permanently attached to a system component at one end and must be removed or replaced along with the component. See Section 1.3, "Internal Components and Cables" on page 1-4 or the service label (located on the left side access panel) for connector locations.

Note – All cables are designed for easy connectivity. Cables cannot be inserted incorrectly unless forced.

- Front I/O board cables:
  - Audio cable
  - USB cable
  - IEEE 1394 cables
  - Power button/LED cable
- DVD drive cables:
  - SATA cable
- HDD cable harness

Each cable connector on the motherboard is labeled to help you identify the cable to which it should be connected.

To remove and install system cables:

1. **Perform the steps listed in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Remove and replace any cables that need to be replaced.**

   As you install each cable, connect one end to the appropriate connector, then route the cable through the cable management straps before connecting the second connector.

4. **Ensure that all cable routing is correct and that all of the cable connectors are properly seated.**

5. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.16 Replacing the Heatsink and CPU

This section describes how to remove or replace a heatsink and CPU.

Note – The CPU is not a customer replaceable unit (CRU) and should be replaced only by trained field service technicians.

Required Tools:

- A long blade Phillips screwdriver (minimum 4–5 inches)
- Antistatic wrist strap and mat

Note – Before removing the CPU from the motherboard, create a backup file to preserve all important data.

5.16.1 Removing the Heatsink and CPU

To remove the heatsink and CPU:

Caution – Parts of the heatsink assembly might be extremely hot. To prevent accidental burns or damage to the heatsink, always handle the heatsink by the black plastic mounting bracket. Allow the heatsink to cool for a few minutes before attempting this procedure.

---

1. **Follow the steps in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Disconnect the heatsink's CPU fan cable from its connector on the motherboard.**

   The CPU fan connector is labeled CPU_FAN.

4. **Remove the heatsink assembly by alternately loosening (2-3 turns) the four screws that secure the assembly to the motherboard (see** FIGURE 5-30**).**

   Continue to alternately loosen each screw until the heatsink assembly is no longer secured to the motherboard.

   The heatsink assembly is also mounted to the top surface of the CPU by a layer of thermal grease, which acts as an adhesive.

FIGURE 5-30 Unlatching the Heatsink-Fan Assembly
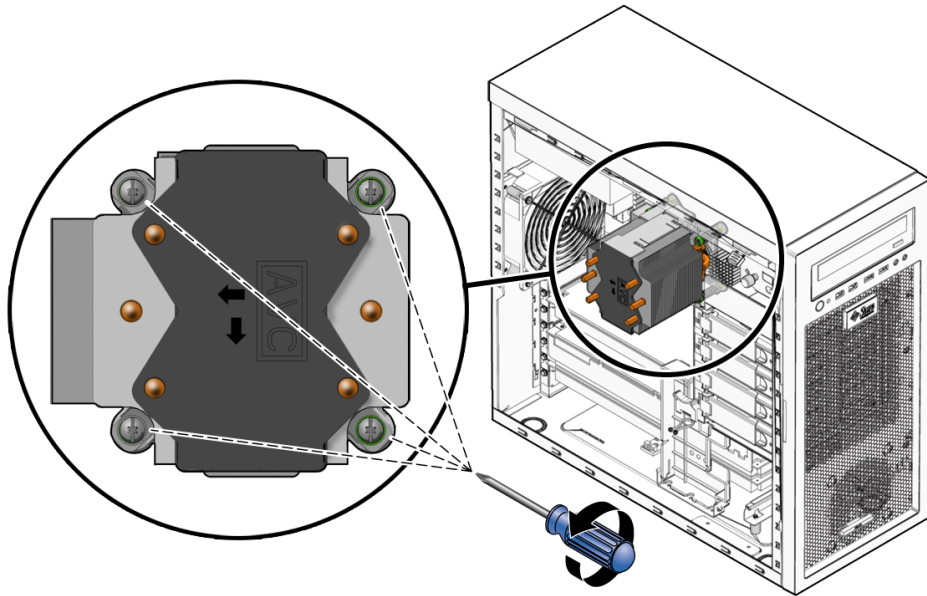
5. **Grasp the heatsink by its plastic mounting bracket, and, while gently pulling upward, slowly wiggle the assembly back and forth to break the adhesive seal of the thermal grease.**

6. **Remove the heatsink-fan assembly from the chassis (see).**

7. **Place the heatsink on its side and on a flat surface to prevent the thermal grease from contaminating other components.**

   You can see the CPU.

8. **Depress the CPU socket retainer lever, and slightly pull the lever outward (away from the CPU) to free the lever from its retaining clip (see** FIGURE 5-31**).**

9. **When you have released the lever from the retaining clip, lift the lever to its fully open (upright) position.**

   This action releases the pressure on the hinged CPU socket retainer.

10. **Lift the unhinged side of the CPU socket retainer to its fully open (upright) position.**

    This action exposes the CPU. The CPU is mounted to a PCB that is keyed (notched) on two opposite sides.

FIGURE 5-31 Removing the CPU From the Workstation
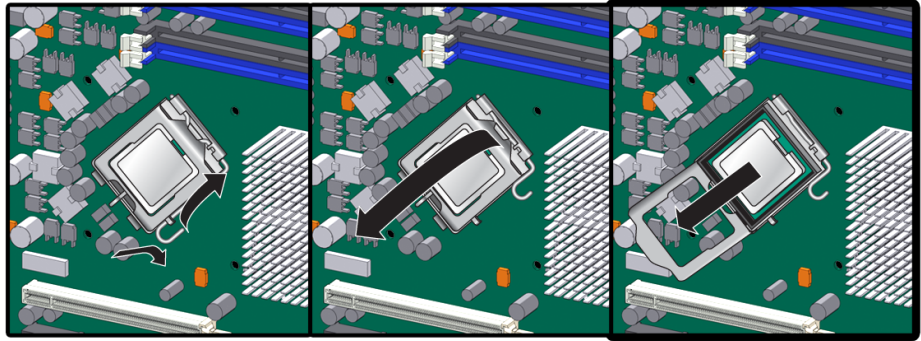
11. **Grasp the notched edges of the CPU PCB, and lift it out of the socket.**

    Set the CPU on an antistatic mat or surface.

12. **To install the heatsink and CPU, use the procedure shown in** Section 5.16.2, "Installing a Heatsink and CPU" on page 5-50**.**

5.16.2   Installing a Heatsink and CPU

To install the heatsink and CPU.

Note – Observe the ESD precautions and preinstallation procedures described in Section 5.1, "Electrostatic Discharge (ESD) Precautions" on page 5-2.

---

1. **Ensure that the CPU socket retainer lever and hinged socket retainer are in the fully open (upright) position (see** FIGURE 5-32**).**

2. **Remove the new CPU from its antistatic packaging.**

    The CPU is mounted on a PCB that is notched on two opposite sides.

3. **Hold the CPU by its notched sides.**

4. **Position the CPU over the CPU socket so that the notches on the PCB align with the keys on the socket.**

5. **Carefully set the CPU onto the socket.**

   When correctly positioned the CPU lies flat in the socket, and the notches on the CPU are aligned with the keys on the socket, restricting movement of the CPU within the socket.

⚠️ **Caution –** Irreparable damage to the motherboard can occur if downward force is applied to the socket. Do not attempt to force the CPU into the socket to seat it.

FIGURE 5-32 Installing the CPU
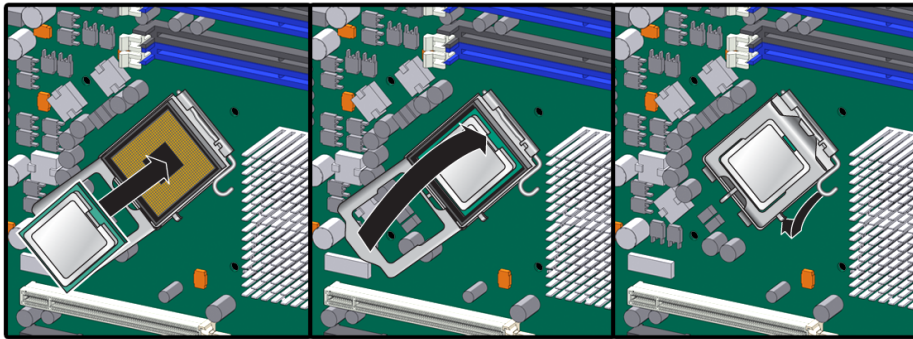
6. **When the CPU is positioned in the socket, lower the hinged socket retainer to cover the CPU.**

7. **Lower the socket retainer lever, pressing it downward, and securing it under the lever retaining clip.**

8. **Do this step only if you are installing a new CPU. Otherwise, go to** Step 9.

   a. **Clean any contamination from the top of surface of the CPU, using the supplied alcohol wipe.**

      The heatsink assembly already has thermal grease applied. You do not need to apply additional thermal grease.

   b. **Remove the plastic cover from the heatsink-fan assembly.**

9. **Do this step if you are installing an already-used CPU onto a new motherboard. Otherwise, go to** Step 10.

   a. **Remove the grease from the CPU and the heatsink using the supplied alcohol wipe.**

   b. **Use the supplied syringe to apply approximately 0.5 ml of thermal grease to the center of the top of the CPU.**

   Empty the entire syringe onto the chip.

c. **Using the wrapper of the alcohol wipe or the clean edge of a plastic bag, spread the thermal grease until it covers the top of the CPU in a thin, uniform layer.**

Caution – Do not use an unprotected finger to spread the thermal grease. The oil on your finger will degrade the performance of the thermal grease.

10. **Inspect the heatsink-fan assembly for dust and lint. Clean if necessary.**

11. **Carefully position the heatsink-fan assembly over the CPU, aligning the screws with the holes in the motherboard.**

12. **Lower the heatsink-fan assembly onto the top of the CPU, avoiding any side-to-side movement. See** FIGURE 5-33**.**

FIGURE 5-33 Installing the Heatsink-Fan Assembly
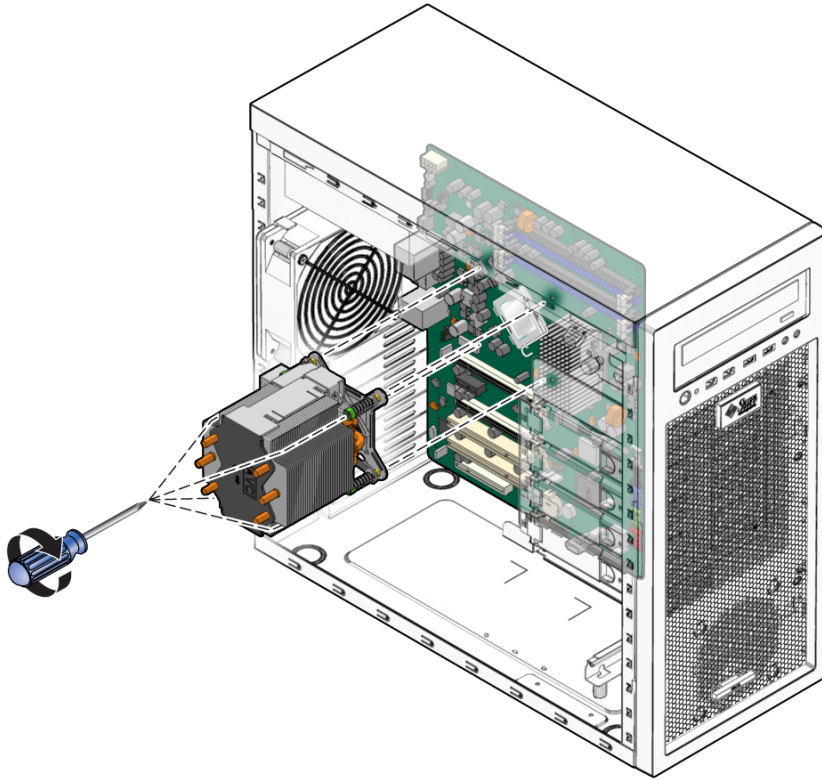
<table>
<tr><td>⚠</td><td>**Caution –** If you move the heatsink assembly too much during installation, the layer of thermal grease might not be distributed evenly, leading to component damage.</td></tr>
</table>

13. **Press down slightly on the top of the heatsink-fan assembly while alternately tightening (3–5 turns) each of the four screws.**

    Continue doing this until the heatsink-fan assembly is secured to the motherboard and you can no longer tighten the screws (see FIGURE 5-34).

<table>
<tr><td>⚠</td><td>**Caution –** Irreparable damage can occur to the motherboard if you attempt to overtighten the heatsink-fan assembly screws.</td></tr>
</table>

FIGURE 5-34 Securing the Heatsink/Fan Assembly Latches

14. **Connect the CPU fan cable to the connector on the motherboard.**

15. **Return the system to the upright position.**

16. **Close the system by performing the steps in** Section 5.3.1, "Postinstallation Instructions" on page 5-5.

5.17 Replacing the Motherboard

The following sections describe how to remove and install the Sun Ultra 24 Workstation system motherboard.

Note – The motherboard is not a CRU and should be replaced only by trained field service technicians.
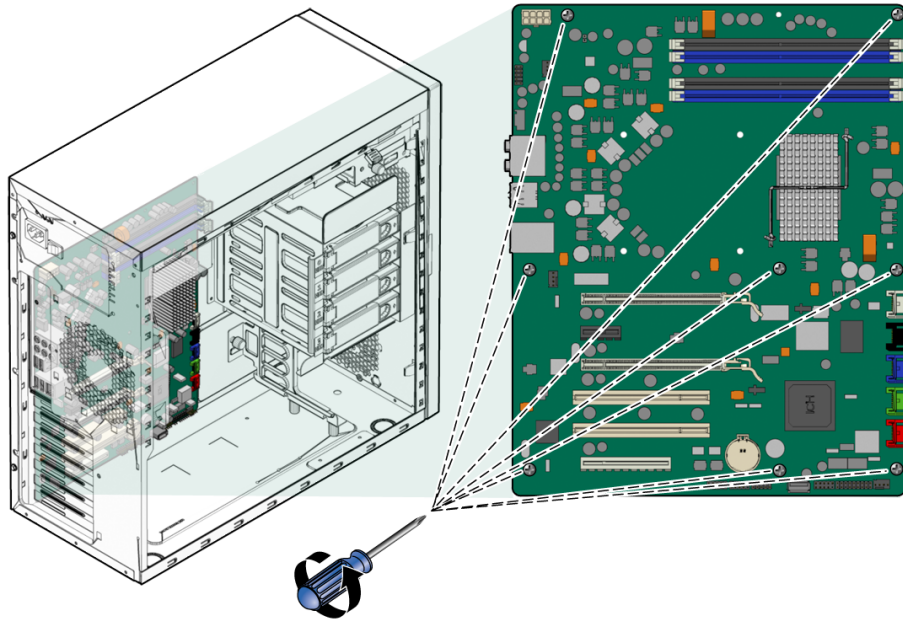

5.17.1 Removing the Motherboard

To remove the motherboard:

1. **Follow the steps in** Section 5.2.2, "Powering Off the System and Removing the Left Side Access Panel" on page 5-3**.**

2. **Gently lay the system on its right side on a stable, nonslip surface.**

3. **Remove any PCI or PCIe cards installed on the motherboard (see** Section 5.10.1, "Removing a PCI Card" on page 5-29**).**

4. **Remove the DIMMs and the CPU from the motherboard.**

5. **Disconnect all cables attached to the motherboard.**

6. **Remove the nine Phillips screws that fasten the motherboard to the chassis (see** FIGURE 5-35**).**

FIGURE 5-35   Removing the Nine Motherboard Screws

7. **Pull the motherboard away from the chassis.**

See the following sections for information about how to remove and replace the CPU and memory:

- Section 5.16, "Replacing the Heatsink and CPU" on page 5-48
- Section 5.8, "Removing or Installing DIMMs" on page 5-23

5.17.2   Installing the Motherboard

A motherboard FRU contains two components, the motherboard and the heatsink mounting bracket. To complete this procedure you must mount the bracket onto the backside of the motherboard before you install the motherboard into the workstation chassis.

⚠️

Caution – Observe proper ESD precautions when handling a new motherboard.

1. **Remove the motherboard from the anti-static packaging.**

   You need to use the internal ESD EPE (pink) foam packaging material as part of this procedure.

2. **Place the motherboard face down onto the ESD EPE foam packaging material.**

   The foam protects the components on the top side of the motherboard and offers additional ESD protection.

3. **Locate the four bracket mounting holes on the backside of the motherboard (see** FIGURE 5-36**).**

FIGURE 5-36 The Four Bracket Mounting Holes on the Backside of the Motherboard
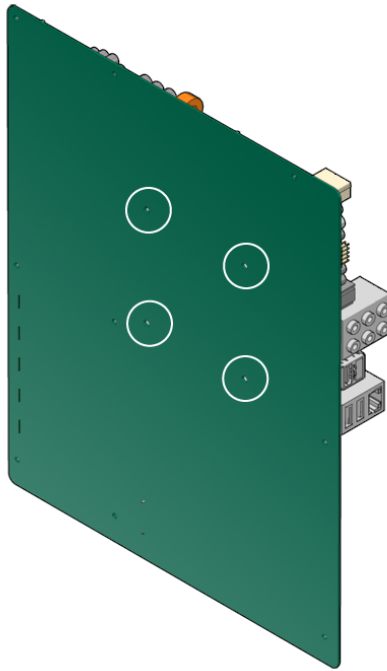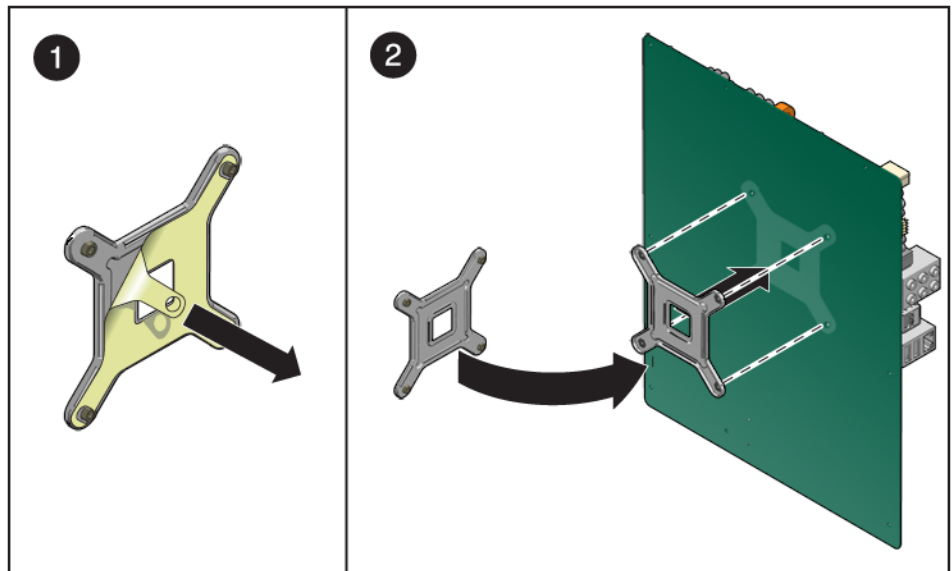

4. **Remove the mounting bracket from the package.**

    One side of the mounting bracket has four threaded standoffs, and a protective paper-backing.

5. **Peel the protective paper-backing from the bracket** (see FIGURE 5-37, panel 1)**.**

    This exposes an adhesive surface on the bracket.

FIGURE 5-37 Installing the Mounting Bracket on to the Backside of the Motherboard

6. **Align the four threaded standoffs on the bracket with the four holes on the back side of the motherboard.**

7. **Place the bracket on to the backside of the motherboard, taking care to seat the threaded standoffs inside the bracket mounting holes** (see FIGURE 5-37, panel 2)**.**

8. **Gently apply enough pressure to the mounting bracket so that the adhesive on the bracket contacts and adheres to the backside of the motherboard.**

Caution – Excessive force can cause irreparable damage to the motherboard and components on the top side of the motherboard.

9. **Turn the motherboard over, and place it in the chassis so that the nine screw holes in the motherboard align with the nine threaded standoffs inside the chassis.**

10. **Fasten the motherboard to the chassis using the nine Phillips screws and a #2 Phillips screwdriver (see** FIGURE 5-38**).**

   Use a torque tool to torque the screws to 8 to 9 inch-pounds.

11. **Install the CPU and heatsink.**

    Refer to the following sections for information about removing and replacing the CPU and heatsink:

    Section 5.16, "Replacing the Heatsink and CPU" on page 5-48

12. **Install the DIMMs as necessary.**

    Refer to the following sections for information about removing and replacing the memory:

    - Section 5.8, "Removing or Installing DIMMs" on page 5-23

13. **Install any PCI cards or a PCIe graphics card. See the following sections:**

    - Section 5.9.2, "Installing a PCIe Card" on page 5-28
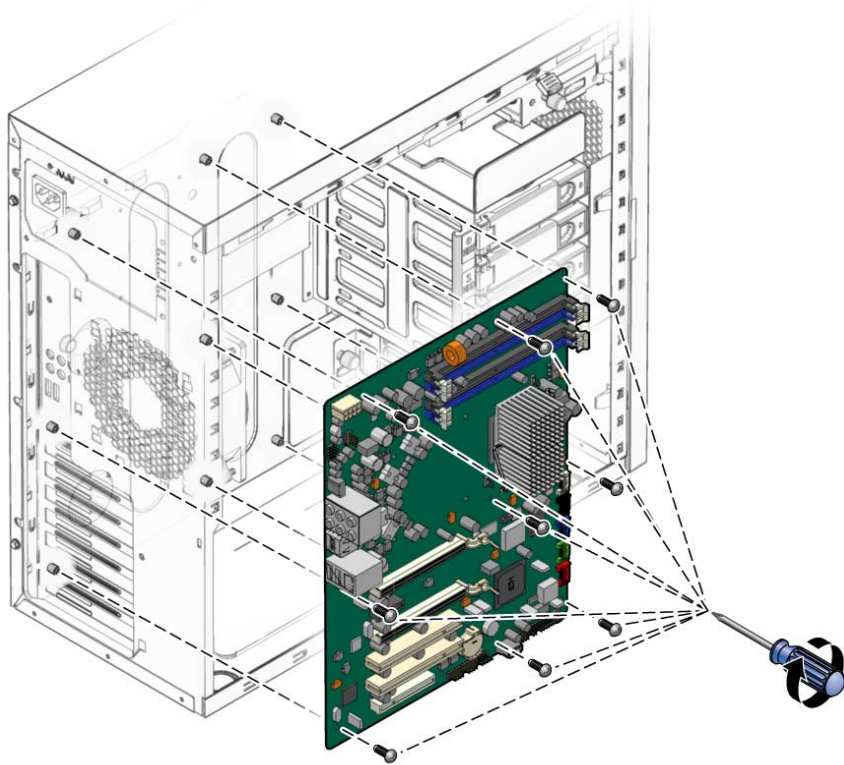   - Section 5.10.2, "Installing a PCI Card" on page 5-31

14. **Reconnect all internal system cables.**

    See Section 5.15, "Replacing System Cables" on page 5-47.

15. **Verify that all system components are securely installed or connected.**

16. Close the system by performing the steps in Section 5.3.1, "Postinstallation Instructions" on page 5-5.

FIGURE 5-38 Installing the Motherboard

5.18 Updating the BIOS

This section contains instructions for flashing the system BIOS and resetting system specific BIOS settings.

5.18.1 Flashing the BIOS

To flash the system BIOS:

1. **Note any BIOS settings that might have been altered for your local environment because flashing the BIOS will restore the default BIOS settings.**

2. **Download the latest Sun Ultra 24 Workstation Tools and Drivers DVD ISO image from the Sun web site:**

   http://www.sun.com/downloads

Caution – Ensure that you download the ISO image for the Sun Ultra 24 Workstation.

---

3. **Burn the image to a DVD.**

4. **Insert the DVD into the system, and then reboot the system.**

5. **When prompted, choose option 2 to flash the BIOS.**

6. **Respond to the prompts, and then wait until the BIOS update is complete.**

7. **Remove the Tools and Drivers DVD from the DVD drive.**

5.18.2   Resetting Previous BIOS Settings

To set the BIOS for your local environment, perform this procedure after updating the BIOS.

1. **Reboot the system.**

2. **Press the F2 key to enter the BIOS configuration.**

   The BIOS Setup screen appears.

3. **Make any setting changes you require. In particular, ensure that RAID settings are enabled if required, and set AHCI for Windows/Linux, IDE for Solaris. For more information, see the** *Sun Ultra 24 Workstation Operating System Installation Guide.*

4. **Press the F10 key to save changes and exit.**

System Specifications

This appendix lists features and specifications for the Sun Ultra 24 Workstation and includes the following sections:

Note – For maximum reliability and performance, install your Sun Ultra 24 Workstation into a proper environment and ensure correct configuration as discussed in this appendix.

A.1   System Components and Features

shows the system's key components.

TABLE A-1   Key System Components

Component	Description
CPU	• One Intel Core2 Duo or Core2 Quad processor • Processor frequencies: 2.0 GHz and faster • Level 2 Cache from 4 MB to 8 MB per processor
Memory	• 8 GB maximum memory • Four DIMM slots • 512 MB, 1 GB, 2 GB registered DDR2-667, registered, ECC DIMM modules supported (see Section A.2, "Memory Configurations" on page A-3)
Media storage	DVD-ROM or DVD-Dual
Hard Drives	Up to four SATA-ll disk drives
Power supply	530W PSU
Network I/O	Onboard 10/100/1000BASE-T Gigabit Ethernet controller with one RJ45 connector on the back panel
Video	PCIe based graphics card
PCIe I/O and PCI I/O	• Two PCI Express x16 slots • One PCI Express x8 mechanical slot (x4 electrical) • One PCI Express x1 slot • One PCI Express • Two PCI 33 MHz 32-bit slots
Other I/O	• Six USB 2.0 connectors (two on the front and four on the back of the workstation) • Two IEEE 1394 connectors on the front panel • Six audio connectors on the back panel (lined up in two rows of three) • Microphone-in jack on the front and back panels • Headphone-out jack on the front panel

A.2 Memory Configurations

TABLE A-2 lists the possible memory configurations for the Sun Ultra 24 Workstation.

The system requires DDR2-667, registered, ECC DIMMs installed in pairs (except for single-DIMM configurations). You can purchase DIMM kits at:

http://store.sun.com

DIMM slots are number from DIMM 0 (closest to CPU) to DIMM 3 (farthest from CPU). You should populate DIMMs in the following order: DIMM slot 3 (black), DIMM slot 1 (black), DIMM slot 2 (blue), and DIMM slot 0 (blue).

TABLE A-2   Sun Ultra 24 Workstation Memory Configurations

Total Memory	Supported DIMM Configuration 1	Supported DIMM Configuration 2
512 MB	1 x 512 MB	
1 GB	2 x 512 MB	
2 GB	2 x 1 GB	4 x 512 MB
3 GB	2 x 1 GB and 2 x 512 MB	
4 GB	2 x 2 GB	4 x 1 GB
5 GB	2 x 2 GB and 2 x 512 MB	
6 GB	2 x 2 GB and 2 x 1 GB	
8 GB	4 x 2 GB	

A.2.1 PCIe and PCI Expansion Slots

TABLE A-3 lists the characteristics of the available PCIe and PCI expansion slots.

TABLE A-3   Internal Expansion Slots

Slot	Connector Type	Length	Height	Description	Position
	Cover Plate, no slot			Nearest to power supply.	Top
PCIe 0	PCIe slot 0 x16	x16	Full	Secondary graphics card slot	
PCIe 1	PCIe x1 slot	x1	Full	Not for graphics accelerators. Intended for PCIe expansion cards such as network interface cards (NIC).	
PCIe 2	PCIe x16 slot (default graphics output)	x16	Full	Primary graphics card slot	
PCI 0	PCI 32-bit/33 MHz slot	Full	Full	32-bit 33MHz, accommodates 64-bit PCI cards, but cards operate in 32-bit mode	
PCI 1	PCI 32-bit/33 MHz slot	Full	Full	32-bit 33MHz, accommodates 64-bit PCI cards, but cards operate in 32-bit mode	
PCIe 3	PCIe x8 mechanical slot (x4 electrical)	x8	Full	Connector is x8, slot is electrically x4	Bottom

A.2.2 Physical Specifications

TABLE A-4 lists the physical specifications for the Sun Ultra 24 Workstation.

TABLE A-4   Sun Ultra 24 Workstation Physical Specifications

Specification	British	Metric
Width	7.9 in.	200 mm
Depth	18.5 in.	470 mm
Height	17.1 in.	435 mm
Weight (maximum with packaging)	34 lb	15.4 kg

A.3 Power Specifications

The maximum continuous power for the Sun Ultra 24 Workstation is 530W.

TABLE A-4, TABLE A-5, and TABLE A-6 list additional power specifications for the system.

TABLE A-5   Input Voltage Range

Input Voltage	Minimum	Nominal	Maximum	Units
Range 1	90	115	132	Vrms
Range 2	180	230	264	Vrms

TABLE A-6   Input Frequency Range

Input Frequency	Minimum	Nominal	Maximum	Units
Range 1	57	60	63	Hz
Range 2	47	50	53	Hz

TABLE A-7   Input Current

Input Voltage	Maximum Input Current	Maximum Inrush Current
Range 1	10A	50 A_{peak}
Range 2	5A	100 A_{peak}

A.4 Environmental Specifications

TABLE A-8 lists the environmental specifications for the Sun Ultra 24 Workstation.

TABLE A-8 Sun Ultra 24 Workstation Environmental Specifications

Specification	State	British	Metric
Humidity	Operating	7%–93% RH noncondensing, 100.4˚ F maximum wet bulb	7%–93% RH noncondensing, 38˚ C maximum wet bulb
	Nonoperating	93% RH, noncondensing, 109.4˚ F maximum wet bulb	93% RH, noncondensing, 43˚ C maximum wet bulb
Vibration	Operating	0.25G in all axes, 5–500 Hz sine	
	Nonoperating	1.2G in all axes, 5–500 Hz sine	
Shock	Operating	4.5G, 11 msec. half-sine	
Temperature	Operating	41˚ F to 95˚ F	5˚ C to 35˚ C
	Nonoperating	–40˚ F to 149˚ F	–40˚ C to 65˚ C
Maximum operating temperature rating		–1.8˚ F for every 985 ft. in altitude	–1˚ C for every 300 m in altitude
Altitude	Operating	maximum 9,843 ft.	maximum 3,000 m
	Nonoperating	maximum 39,370 ft.	maximum 12,000 m

BIOS POST Codes

Typically, the BIOS displays warning or error messages on the video display in the event of hardware or configuration errors.

However, if the error is so severe that the BIOS halts immediately or cannot initialize the video, you can read the last executed POST code from the port 80 LED.

The port 80 LED is located on the motherboard (see FIGURE B-1). The BIOS POST codes are listed in TABLE B-1.

FIGURE B-1 Location of Port 80 LED
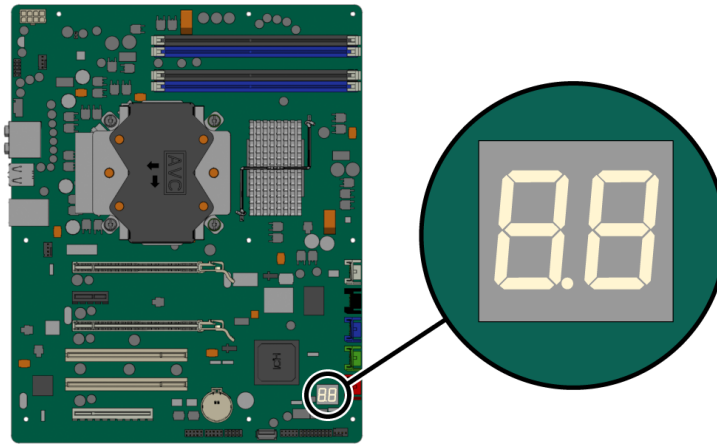
TABLE B-1 BIOS Port 80 POST Codes

Post Code	Description
CFh	Test CMOS R/W functionality.
C0h	Early chipset initialization: • Disable shadow RAM. • Disable L2 cache (socket 7 or below). • Program basic chipset registers.
C1h	Detect memory: • Auto detection of DRAM size, type, and ECC. • Auto detection of L2 cache (socket 7 or below).
C3h	Expand compressed BIOS code to DRAM.
C5h	Call chipset hook to copy BIOS back to E000 & F000 shadow RAM.
01h	Expand the Xgroup codes locating in physical address 1000:0.
02h	Reserved.
03h	Initial Superio_Early_Init switch.
04h	Reserved.
05h	1. Blank out screen. 2. Clear CMOS error flag.
06h	Reserved.
07h	1. Clear 8042 interface. 2. Initialize 8042 self-test.

TABLE B-1   BIOS Port 80 POST Codes *(Continued)*

Post Code	Description
08h	1. Test special keyboard controller for Winbond 977 series Super I/O chips. 2. Enable keyboard interface.
09h	Reserved.
0Ah	1. Disable PS/2 mouse interface (optional). 2. Auto detect ports for keyboard and mouse followed by a port and interface swap (optional). 3. Reset keyboard for Winbond 977 series Super I/O chips.
0Bh	Reserved.
0Ch	Reserved.
0Dh	Reserved.
0Eh	Test F000h segment shadow to see whether it is read/writable or not. If test fails, keep beeping the speaker.
0Fh	Reserved.
10h	Autodetect flash type to load appropriate flash R/W codes into the runtime area in F000 for ESCD & DMI support.
11h	Reserved.
12h	Use walking 1's algorithm to check out interface in CMOS circuitry. Also, set real-time clock power status, and then check for override.
13h	Reserved.
14h	Program chipset default values into chipset. Chipset default values are MODBINable by OEM customers.
15h	Reserved.
16h	Initial onboard clock generator if Early_Init_Onboard_Generator is defined. See also POST 26h.
17h	Reserved.
18h	Detect CPU information including brand, SMI type (Cyrix or Intel), and CPU level (586 or 686).
19h	Reserved.
1Ah	Reserved.
1Bh	Initial interrupts vector table. All hardware interrupts are directed to SPURIOUS_INT_HDLR and software interrupts to SPURIOUS_soft_HDLR.
1Ch	Reserved.
1Dh	Initial EARLY_PM_INIT switch.

Post Code	Description
1Eh	Reserved.
1Fh	Load keyboard matrix (notebook platform).
20h	Reserved.
21h	HPM initialization (notebook platform).
22h	Reserved.
23h	1. Check validity of RTC value. For example, a value of 5Ah is an invalid value for RTC minute. 2. Load CMOS settings into BIOS stack. If CMOS checksum fails, use default value instead.
24h	Prepare BIOS resource map for PCI and PnP use. If ESCD is valid, consider the ESCD's legacy information.
25h	Early PCI initialization: • Enumerate PCI bus number. • Assign memory and I/O resource. • Search for a valid VGA device and VGA BIOS, and put it into C000:0.
26h	1. If Early_Init_Onboard_Generator is not defined, Onboard clock generator initialization. Disable respective clock resource to empty PCI and DIMM slots. 2. Initialize onboard PWM. 3. Initialize onboard H/W monitor devices.
27h	Initialize INT 09 buffer.
28h	Reserved.
29h	1. Program CPU internal MTRR (P6 and PII) for 0–640K memory address. 2. Initialize the APIC for Pentium class CPU. 3. Program early chipset according to CMOS setup. Example: onboard IDE controller. 4. Measure CPU speed.
2Ah	Reserved.
2Bh	Invoke video BIOS.
2Ch	Reserved.
2Dh	1. Initialize double-byte language font (optional). 2. Display information on screen, including award title, CPU type, CPU speed, and full-screen logo.
2Eh	Reserved.

TABLE B-1   BIOS Port 80 POST Codes *(Continued)*

Post Code	Description
2Fh	Reserved.
30h	Reserved.
31h	Reserved.
32h	Reserved.
33h	Reset keyboard if Early_Reset_KB is defined. For example, Winbond 977 series Super I/O chips. See also POST 63h.
34h	Reserved.
35h	Test DMA channel 0.
36h	Reserved.
37h	Test DMA channel 1.
38h	Reserved.
39h	Test DMA page registers.
3Ah	Reserved.
3Bh	Reserved.
3Ch	Test 8254.
3Dh	Reserved.
3Eh	Test 8259 interrupt mask bits for channel 1.
3Fh	Reserved.
40h	Test 8259 interrupt mask bits for channel 2.
41h	Reserved.
42h	Reserved.
43h	Test 8259 functionality.
44h	Reserved.
45h	Reserved.
46h	Reserved.
47h	Initialize EISA slot.
48h	Reserved.
49h	1. Calculate total memory by testing the last double word of each 64K page. 2. Program-write allocation for AMD K5 CPU.
4Ah	Reserved.

TABLE B-1   BIOS Port 80 POST Codes *(Continued)*

Post Code	Description
4Bh	Reserved.
4Ch	Reserved.
4Dh	Reserved.
4Eh	1. Program MTRR of M1 CPU. 2. Initialize the L2 cache for P6 class CPU and program CPU with proper cacheable range. 3. Initialize the APIC for P6 class CPU. 4. On MP platform, adjust the cacheable range to a smaller one in case the cacheable ranges between each CPU are not identical.
4Fh	Reserved.
50h	Initialize USB keyboard and mouse.
51h	Reserved.
52h	Test all memory (clear all extended memory to 0).
53h	Clear the password according to H/W jumper (optional).
54h	Reserved.
55h	Display the number of processors (multiprocessor platform).
56h	Reserved.
57h	1. Display PnP logo. 2. Early ISA PnP initialization. Assign CSN to every ISA PnP device.
58h	Reserved.
59h	Initialize the combined Trend Anti-Virus code.
5Ah	Reserved.
5Bh	(Optional feature) Show message for entering AWDFLASH.EXE from FDD.
5Ch	Reserved.
5Dh	1. Initialize Init_Onboard_Super_IO. 2. Initialize Init_Onbaord_AUDIO.
5Eh	Reserved.
5Fh	Reserved.
60h	Okay to enter setup utility; users cannot enter the CMOS setup utility until this POST stage.
61h	Reserved.
62h	Reserved.

TABLE B-1 BIOS Port 80 POST Codes *(Continued)*

Post Code	Description
63h	Reset keyboard if Early_Reset_KB is not defined.
64h	Reserved.
65h	Initialize PS/2 Mouse.
66h	Reserved.
67h	Prepare memory size information for function call: INT 15h ax=E820h.
68h	Reserved.
69h	Turn on L2 cache.
6Ah	Reserved.
6Bh	Program chipset registers according to items described in Setup & Auto-configuration table.
6Ch	Reserved.
6Dh	1. Assign resources to all ISA PnP devices. 2. Autoassign ports to onboard COM ports if the corresponding item in setup is set to AUTO.
6Eh	Reserved.
6Fh	1. Initialize diskette controller. 2. Set up diskette-related fields in 40:hardware.
70h	Reserved.
71h	Reserved.
72h	Reserved.
73h	Reserved.
74h	Reserved.
75h	Detect and install all IDE devices: HD, LS120, ZIP, CD-ROM, and so on.
76h	(Optional feature) Enter AWDFLASH.EXE if: • AWDFLASH.EXE is found on diskette drive. • Alt+F2 is pressed.
77h	Detect serial ports and parallel ports.
78h	Reserved.
79h	Reserved.
7Ah	Detect and install coprocessor.
7Bh	Reserved.

Post Code	Description
7Ch	Initialize HD write-protect.
7Dh	Reserved.
7Eh	Reserved.
7Fh	Switch back to text mode if full-screen logo is supported. • If errors occur, report errors and wait for keys. • If no errors occur or you press the F1 key to continue: Clear EPA or customization logo.
80h	Reserved.
81h	Reserved.
E8POST.ASM starts.	
82h	1. Call chipset power management hook. 2. Recover the text font used by EPA logo (not for full-screen logo). 3. If password is set, ask for password.
83h	Save all data in stack back to CMOS.
84h	Initialize ISA PnP boot devices.
85h	1. USB final initialization. 2. Switch screen back to text mode.
86h	Reserved.
87h	NET PC: Build SYSID Structure.
88h	Reserved.
89h	1. Assign IRQs to PCI devices. 2. Set up ACPI table at top of the memory.
8Ah	Reserved.
8Bh	1. Invoke all ISA adapter ROMs. 2. Invoke all PCI ROMs (except VGA).
8Ch	Reserved.
8Dh	1. Enable or disable parity check according to CMOS setup. 2. APM initialization.
8Eh	Reserved.
8Fh	Clear noise of IRQs.
90h	Reserved.
91h	Reserved.
92h	Reserved.

TABLE B-1 BIOS Port 80 POST Codes *(Continued)*

Post Code	Description
93h	Read HD boot sector information for Trend Anti-Virus code.
94h	1. Enable L2 cache. 2. Program daylight savings time. 3. Program boot-up speed. 4. Chipset final initialization. 5. Power management final initialization. 6. Clear screen and display summary table. 7. Program K6 write allocation. 8. Program P6 class write combining.
95h	Update keyboard LED and typematic rate.
96h	1. Build MP table. 2. Build and update ESCD. 3. Set CMOS century to 20h or 19h. 4. Load CMOS time into DOS timer tick. 5. Build MSIRQ routing table.
FFh	Boot attempt (INT 19h).

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